22 APRIL 1955

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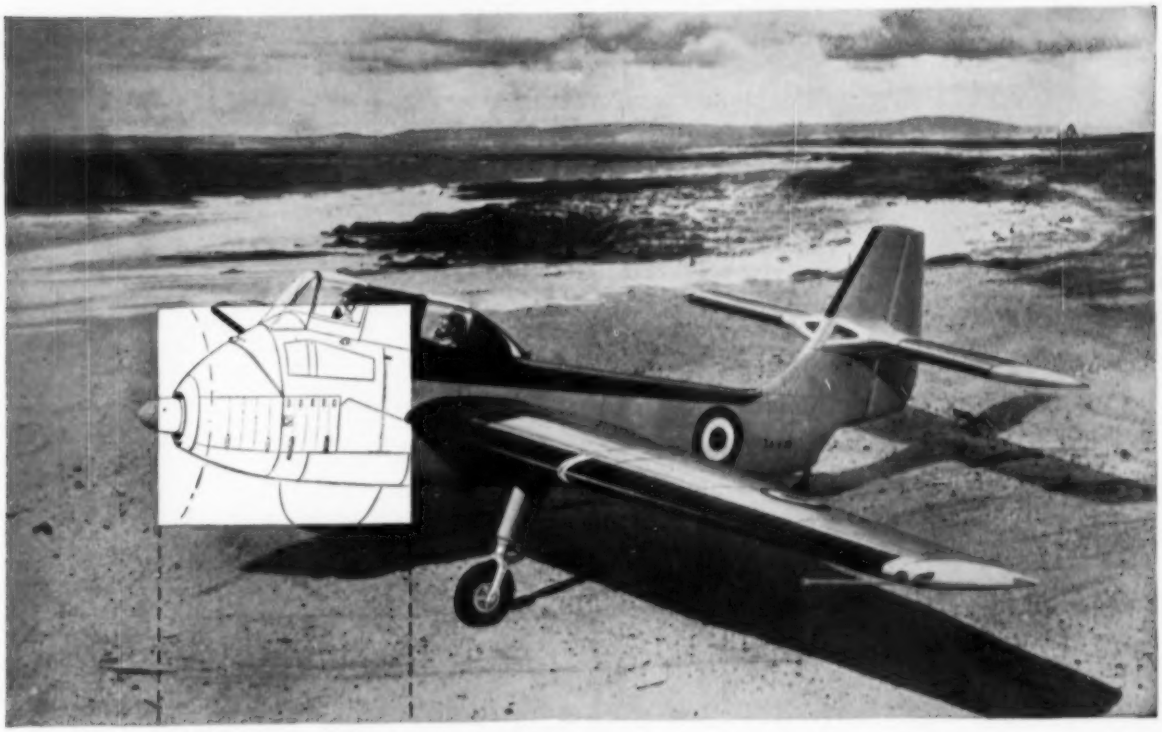

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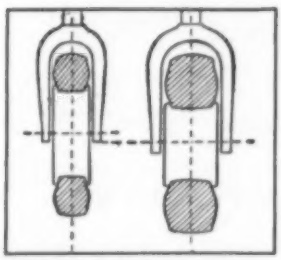
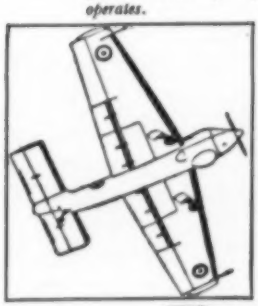


The wheels of the Seamew can be swiftly changed, with differing sizes of tyre to suit the surfaces from which it operates.



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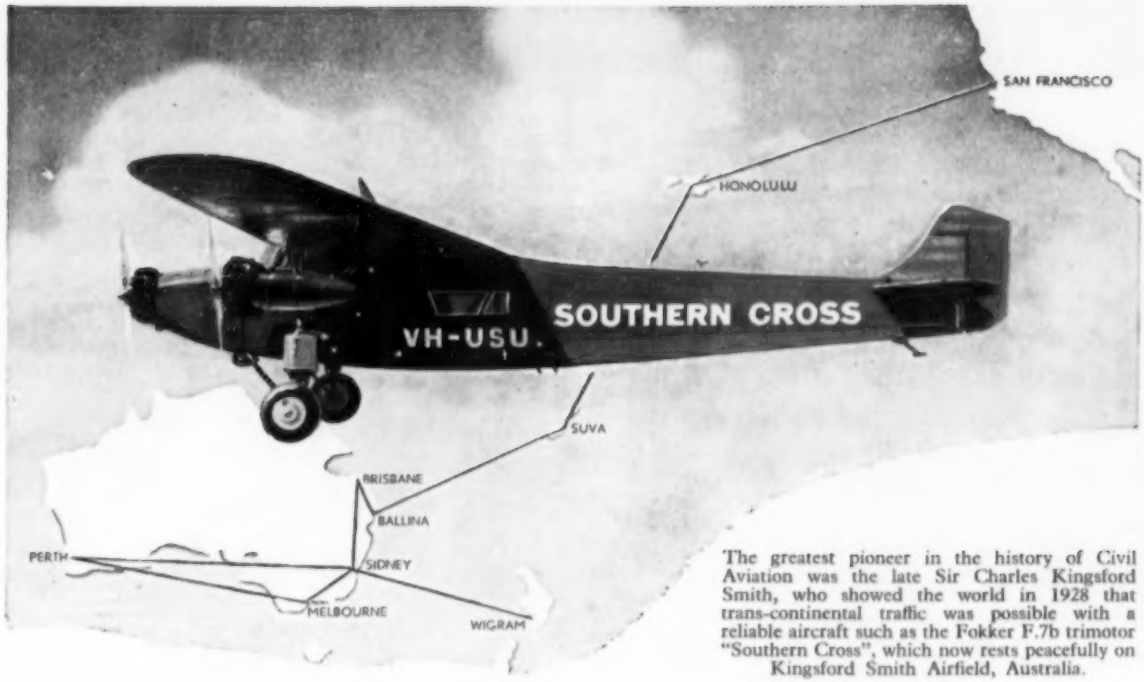

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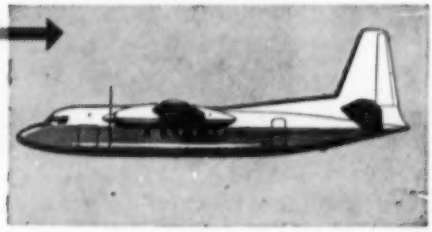

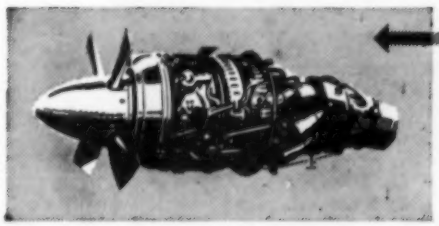

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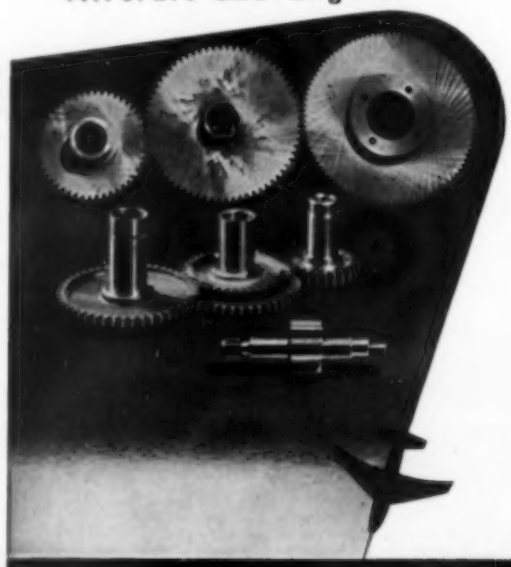

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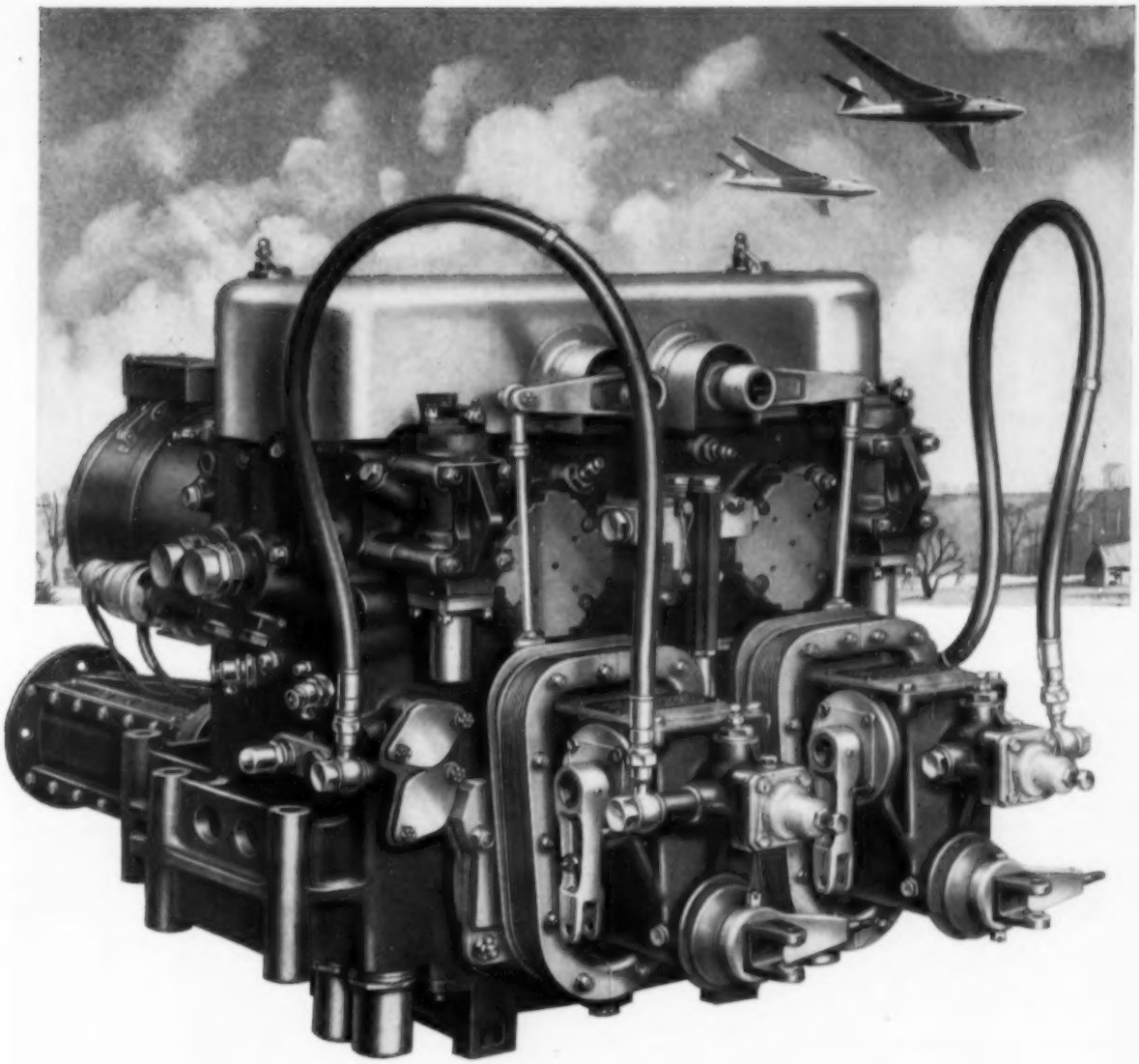

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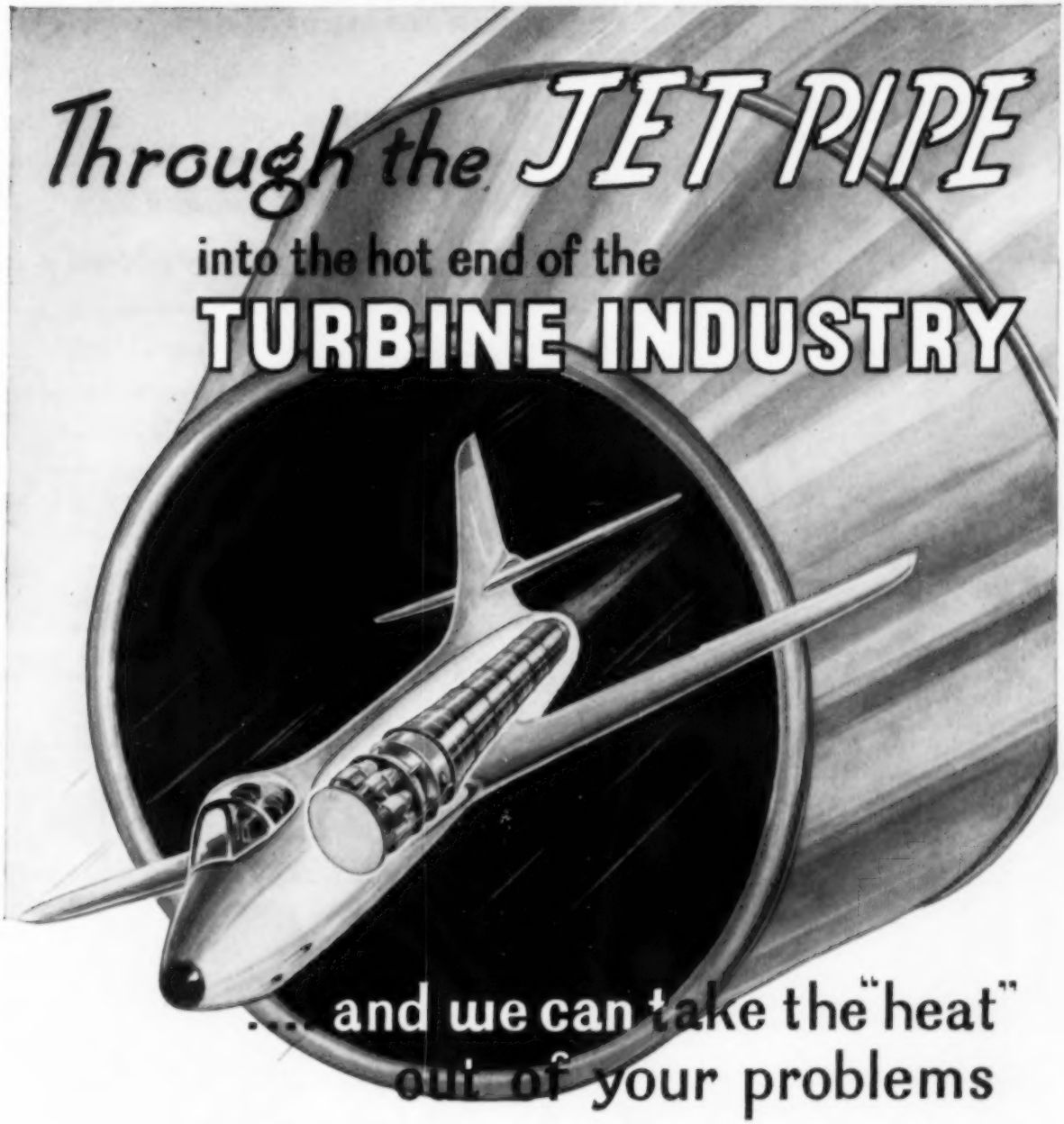

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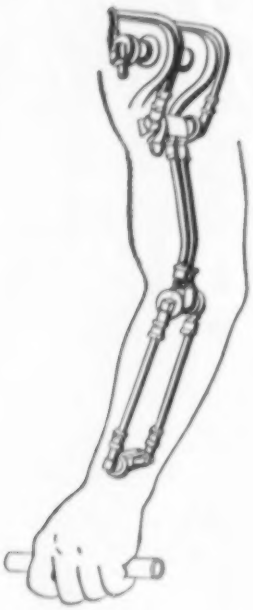

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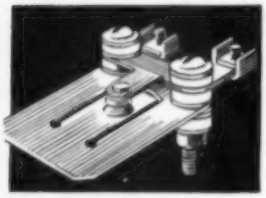

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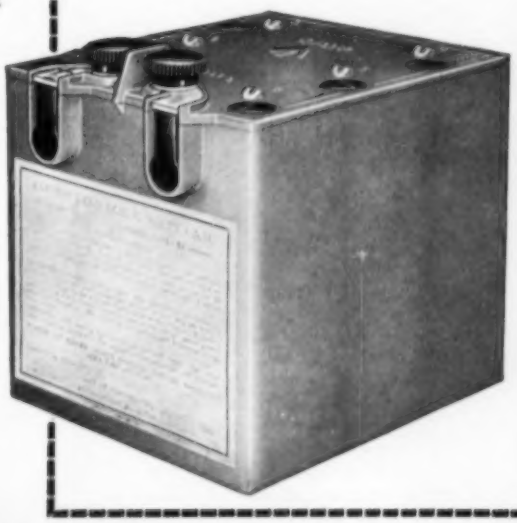

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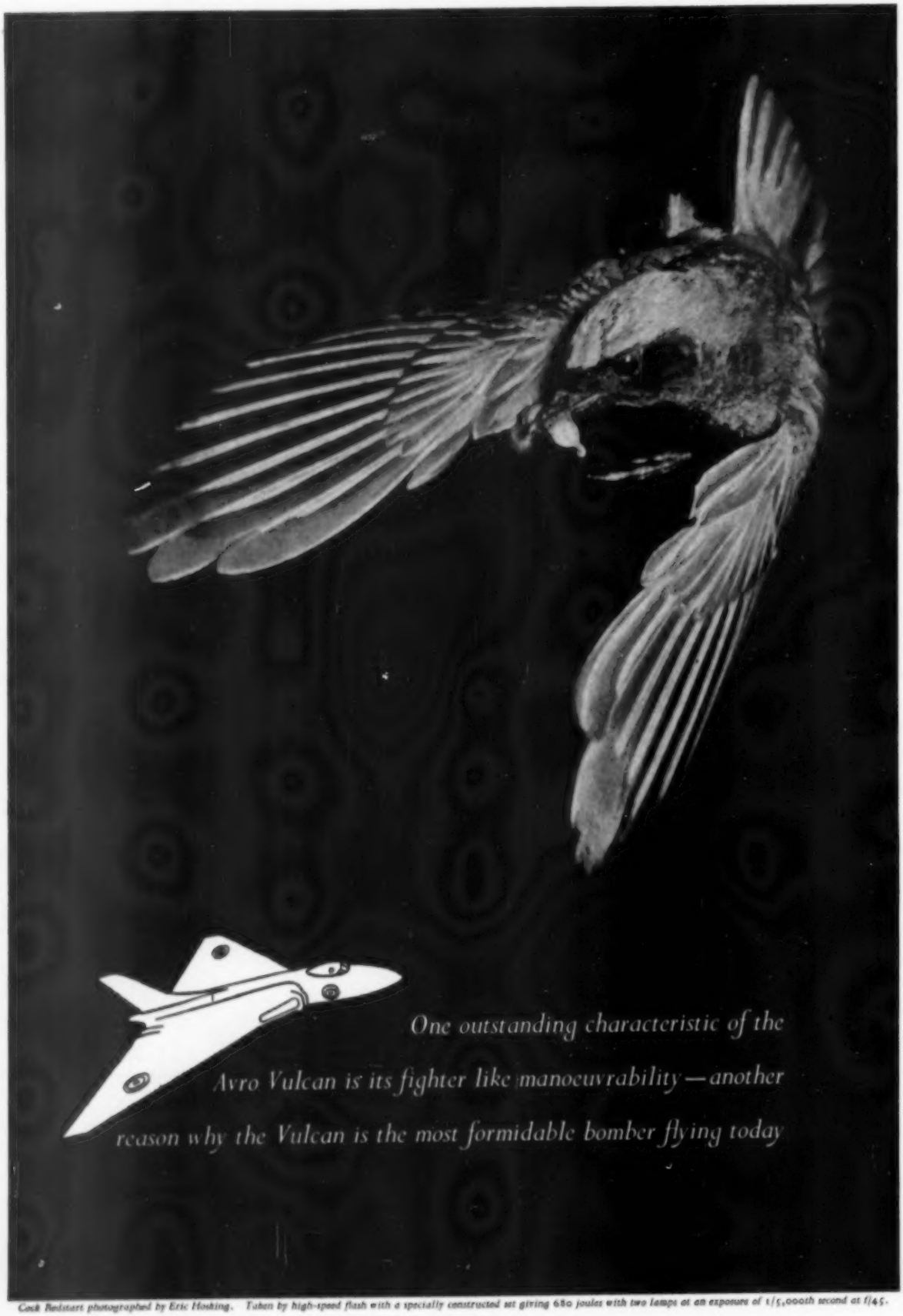
One outstanding characteristic of the
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Cock Redstart photographed by Eric Hosking. Taken by high-speed flash with a specially constructed set giving 650 joules with two lamps at an exposure of 1/5,000th second at f/45.

FLIGHT
and
AIRCRAFT ENGINEER

First Aeronautical Weekly in the World

Founded 1909

No. 2413 Vol. 67. FRIDAY, 22 APRIL 1955

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A Day at the Airport

FOR London Airport, last Sunday, April 17th, was a doubly important day. The opening of the new central terminal area coincided with the start of "summer" schedules, bringing greatly increased tempo of service to nearly all destinations. The weather, for once, matched the occasion. The first services to use the new terminal —the honour fell to two B.E.A. Viscounts—made their respective arrival and departure under a cloudless sky at 7.30 a.m., and by mid-day bright April sunshine was inviting long lines of motor-borne taxpayers to inspect their latest acquisition. Taking an early opportunity to see the new terminal in action, *Flight* also followed the brand-new signs pointing the way to "London Airport Central."

Two sections of the area came into use on Sunday: the control tower and approximately two-thirds of the South-east Face Passenger Handling Building, now the point of loading for most of the short-haul services operating to and from London. The name of the building, incidentally, is even more of a mouthful than that of the authority responsible for it (The Ministry of Transport and Civil Aviation, who should shorten both titles).

The hundreds of airline and airport staff newly transferred from the temporary terminal at "L.A.P. North" appeared to be settling down quickly in their unfamiliar though much improved surroundings. Undoubtedly there were many problems behind the scenes, but for the most part passengers seemed scarcely aware of the great change under way. Admittedly, we saw one group of irate travellers who, by reporting to the wrong terminal, had missed their flight; but this unfortunate introduction was, we hope, exceptional.

Now that at least part of the plans, diagrams, charts and models of the new terminal have come to life, it is timely to record some initial impressions. The first sight of the central area is satisfying, despite the inevitable untidiness resulting from construction work still in progress, and it is good to see that London is at last well on the way to possessing an air terminal which is more than a match for the imposing facilities provided at many cities overseas. Externally, the buildings have a solid, handsome aspect; within, they are spacious, light and, generally speaking, excellently styled and appointed. Red brick may not be the usual, nor even the most logical, medium for buildings of this type, but its use here at least assures London Airport a distinction from its counterparts abroad.

The "airside" aspect of the passenger building is not quite as attractive as models and plans had led us to hope. This is not due to any shortcomings of the building proper, but to the erection of massive floodlight standards which dominate the apron area.

L.A.P. Central is of diamond shape; on the NE./SE. sides are parking areas with accommodation for 34 aircraft, though as yet only the south-east face of the diamond is in use. The parking areas are divided by one taxi-track, and enclosed by a second. This layout is conducive to the smooth flow of taxying aircraft, but it has one major disadvantage: aircraft on the outer stands are accessible only through a subway emerging on the outer perimeter of the apron. Buses are used to carry passengers to and from aircraft in the outer stands. Superficially at least, this seems to be the most inflexible and least economic part of the new handling arrangements. Possibly the airport authorities have in mind the eventual use of some form of escalator-cum-conveyor-belt running between the terminal building and the outer standing. It occurs to us that if traffic builds up to the peak expected within the next few years the number of coach movements per day will run into thousands—and coaches probably represent only a small percentage of the total number of vehicles moving around the apron.

Most American airports have for many years employed the gate system, whereby passengers make their own way under cover to numbered doors leading direct to the aircraft. It is perhaps significant that the system has been retained at the proposed new terminal for New York International Airport (described on page 534 of this issue), which will have no fewer than 140 parking positions. As an alternative to the conventional gate, experiments are also being conducted in America with a system whereby the aircraft is mechanically parked adjacent to a permanent loading dock.

But contrasting approaches to similar problems indicate the extent to which even the experts differ. Nonetheless, it is difficult to feel enthusiasm for the idea of retaining a passenger-handling arrangement which was originally nothing more than an expedient.

FROM ALL QUARTERS

The New Supply Appointments

AS we briefly reported last week, the Ministerial changes announced immediately before the Easter recess included the appointment of Mr. Reginald Maudling as Minister of Supply in succession to Mr. Selwyn Lloyd, who has been made Minister of Defence.

Mr. Maudling, who was educated at Merchant Taylors' and Merton College, Oxford, is 38 years of age. He has been Con-

Mr. Maudling.

Mr. Erroll.

servative Member for the Barnet Division of Hertfordshire since 1950 and Economic Secretary to the Treasury for the past two years. He was called to the Bar in 1940 and served in the R.A.F., later going to the Air Ministry as private secretary to the Secretary of State for Air. In 1952 he was Parliamentary Secretary to the Minister of Civil Aviation.

Appointed Parliamentary Secretary to the Ministry of Supply is Mr. F. J. Erroll, Conservative M.P. for Altrincham and Sale since 1945. Forty-one years of age, he has considerable technical experience, particularly in electrical engineering (he is an M.A., A.M.I.E.E. and A.M.I.Mech.E.) and is a director of a number of companies. During his Army service in the war he held technical posts in connection with tank development, and he served in India and Burma in 1944-45. From 1948 to 1952 he was deputy chairman of the Parliamentary Scientific Committee.

L.A.P. Central in Action

LONDON AIRPORT'S new central terminal came into use on Sunday last, April 17th. First aircraft to depart from the south-east apron—at 7.36 a.m.—was a B.E.A. Viscount, G-AMOA *George Vancouver*, operating the first regularly scheduled service to Amsterdam by this type of aircraft. As G-AMOA was cleared to taxi, another Viscount—G-AMNZ *James Cook*, from Birmingham—became the first aircraft to arrive at the new apron. Viscount services, including those of Air France and Aer Lingus, represented a high proportion of flights operated to and from the new terminal, including the inaugural "Festival" service between Edinburgh and London. The first Viscount to cover this route completed the 330 miles in 1 hr 20 min (20 min ahead of schedule). Other types in evidence included Elizabethans, DC-3s and DC-6s. Pilots reported savings of some five minutes in taxying time as a function of the central location of the terminal.

G-ANBA Returns

A TOTAL of 46 crew and passengers were aboard Britannia G-ANBA on the flight from Khartoum to Filton which, as reported on page 526, brought the tropical trials to a successful conclusion. Among those waiting to welcome the aircraft at Filton were Sir Alec Coryton and Mr. C. F. Uwins, managing directors of Bristol's Engine and Aircraft Divisions respectively, and the company's chief test pilot, Mr. "Bill" Pegg, who is convalescing after an appendicitis operation. Assistant chief test pilot Walter Gibb, who was in charge of the trials, said that they had been completed "most satisfactorily" in less than the five weeks allowed. Since its departure for Africa the aircraft had logged a total of 91 flying hours. Shade temperatures as high as 108 deg F had been found at Khartoum; at one time the skin temperature of the aircraft reached 168 deg. The reactions of the technicians working inside the aircraft at the time are not recorded.

In a message to the manufacturers, Sir Miles Thomas said: "The encouraging performance of the Britannia is indeed a happy augury for this new British product—the world's first large turbo-propeller long-range airliner. My warmest congratulations to you all in the Bristol Aeroplane Company."

Three more Viscounts for T.C.A.

AS foreshadowed in *Flight* last week, Trans-Canada Air Lines have decided to increase their order for Viscounts. The company has ordered three more Viscount 724s for delivery early in 1957, bringing its total order to 25 aircraft. Including spares, the value of the T.C.A. contract has now reached £8.5m. To date, Vickers-Armstrongs have sold a total of 183 Viscounts to 20 customers—three governments and 17 airlines, of whom four (B.E.A., Capital, Hunting-Clan and T.C.A.) have increased their initial orders.

Belfast-built Canberras

AN announcement on April 13th by Short Brothers and Harland, Ltd., to the effect that instructions they had received would lead to the paying-off of a considerable number of employees, was quickly followed by an M.o.S. statement in the following terms:—

"Following the decision by Her Majesty's Government to restrict production of the Swift Mark 4 it has been necessary for Messrs. Vickers-Armstrongs to cancel subcontracts which had been placed with Messrs. Short Brothers and Harland in Belfast.

"Her Majesty's Government have been much concerned to alleviate the effect of these cancellations on the employment situation in Northern Ireland. It will be recalled that, following arrangements made with the Bristol Aeroplane Company, the

FRESH APRON: The start of summer schedules on Sunday last coincided with the opening of London Airport's new terminal area, situated at the heart of the runway system. Pictured here on the opening day are (left) a view of the new buildings from the "outer standing" and a close-up of the "waving base" overlooking the apron. The Viscount at left was the first aircraft to leave the new terminal.

"Flight" photographs

***HIGHLY ADAPTABLE** to the most unlikely installations is the Avro Ashton, now serving as a flying test-bed for an underslung Rolls-Royce Avon, as seen here. This particular Ashton (six were built in all) was formerly fitted with under-wing bomb pods.*

production of eight Britannias Mark 250 is to be undertaken by Messrs. Short Brothers and Harland, involving the employment of about 1,500 men by mid-1956."

The M.o.S. statement then goes on to refer to a new arrangement for Shorts to build more Canberras, so providing employment for 200 men by June, and a total of 600 in due course. In addition, "the company are seeking a Government order for a type of aircraft currently in production . . ."

On April 15th Short Bros. made a second announcement, in which it was disclosed that the Bristol Aeroplane Co. had given an order for a further seven Britannias (Mk 300). It now seemed likely that the redundancy figure of 900, originally quoted, was likely to be reduced to 700 at the maximum.

Capt. Majendie Joins A.R.B.

THE M.T.C.A. announce the appointment of Capt. A. M. A. Majendie, M.A., A.F.R.Ae.S., as a member of the Council of the Air Registration Board. He succeeds Capt. M. J. R. Alderson, O.B.E., whose term of service has recently expired. The Civil Aviation Act, 1949, provides for the appointment by the Minister of Transport and Civil Aviation of two A.R.B. council-members, one of whom must be a professional pilot of not less than five years' experience.

It is likely that pilots will welcome the Minister's choice of Capt. Majendie, who combines practical flying skill and experience with a clear, analytical mind. Now aviation research liaison officer with Smiths Aircraft Instruments, he served as a pilot with B.O.A.C. from 1946-54. As flight captain of the Comet Fleet, he was responsible for the airline development work which preceded the introduction of the jet airliner to scheduled service with B.O.A.C. In 1954 he was awarded the Queen's Commendation for Valuable Services in the Air.

Major F. B. Halford

IT is with great regret that *Flight* has to record the death of Major F. B. Halford, C.B.E., F.R.Ae.S., chairman and technical director of the de Havilland Engine Co., Ltd., since 1944 and a director of the de Havilland Aircraft Co., Ltd. He died suddenly at his home in Northwood, Middlesex, on Saturday last, after being at work as usual in his office on the previous day. He was 61 years of age.

Frank Bernard Halford was educated at Felsted and Nottingham University. He learned to fly before the First World War and in 1914 was an instructor at the Brooklands School of Flying. He joined the newly formed Aircraft Inspection Department in 1914 as an engine examiner and served in the R.F.C. and R.A.F. from then until 1919, during which period his exceptional technical ability soon came to be recognized. In 1918 the Air Ministry placed his services at the disposal of William Beardmore and Co., and the Ricardo Company, for engine development work. During the war he had been working on an engine known as the B.H.P. (Beardmore - Halford - Pullinger) a six-in-line unit from which in due course he obtained the then very high figure of 230 b.h.p. It was used in the early D.H.4s and was afterwards put into quantity production as the Siddeley Puma. It was in connection with the D.H.4 prototype that he first came into close contact with Capt. (now Sir Geoffrey) de Havilland and other founder-members of the Aircraft Manufacturing Company.

Maj. Halford.

A V-12 development of the B.H.P., the 500 h.p. Atlantic, was evolved, and tested in a D.H.9a; it was the forerunner of the Siddeley Pacific which would have been used to power aircraft for bombing Berlin had the war not ended. Major Halford then collaborated with H. R. (now Sir Harry) Ricardo on the earliest supercharged engines. He spent two-and-a-half years in the United States negotiating licence agreements and on his return to England assisted in such developments as the Triumph-Ricardo motor cycle, with which he himself established a 500 c.c. hour record at Brooklands at just under 70 m.p.h. When he set up on his own in 1923—assisted by Mr. J. L. P. Brodie, who is now director in charge of engineering at the de Havilland Engine Co.—he was at first engaged on the development of engines for racing cars, which he successfully drove at Brooklands and elsewhere on a number of occasions. From 1924 to 1927 he worked for the A.D.C. Company on the Airdisco Cirrus —forerunner of the Gipsy—and Nimbus engines. Leaving A.D.C. in 1927, he moved from Croydon to London and concentrated on the Gipsy and on a revolutionary new engine for Napiers—the 16-cylinder Rapier, the first H-type engine. In that year he recruited to his little design-office Dr. E. S. Moult, who is now chief engineer of the de Havilland Engine Co.

Halford's steady design-development of the Gipsy engine continued through the thirties; in 1935 he was awarded the R.Ae.S. Silver Medal for this work, with special reference to the victory of the original D.H. Comet in the England-Australia Race.

During the Second World War he was occupied with the development of the Napier Sabre engine (which, developed from the Rapier and Dagger, powered the Typhoon) and in the new field of gas turbines which he entered early in 1941. He had become technical director of Napiers in 1935, a position which he relinquished before the de Havilland Engine Co. was formed under his technical direction in 1944.

His clear thinking on jet propulsion was evident in a paper which earned for him the Silver Medal of the Royal Society of Arts in 1946. His achievements since the war are well remembered, including as they do the design of the Goblin, Ghost and Gyron—and, it may be added, others yet to be publicly known. He was vice-president of the Royal Aeronautical Society in 1950-51 and president in 1951-52.

A Memorial Service is to be held at Christ Church, Down Street, London, W.1, on Thursday, May 5th, at 11.30 a.m.

Boundary-layer Control for Lockheed T2V-1

IT has long been appreciated that great gains can be realized by sucking, blowing, or in some other way controlling the boundary-layer around the wing of an aircraft. (The subject was outlined in *Flight* of November 12th, 1954, and January 7th and 14th, 1955). It is, therefore, of some importance to note that a machine is now in production with boundary-layer control as a standard feature. It is a highly refined, but orthodox, jet trainer for the U.S. Navy.

The prototype, styled Lockheed 245, was first illustrated in our issue of February 19th, 1954; basically, it is a direct development of the familiar TV or T-33 tandem-seat trainer, with the following modifications apart from the boundary-layer control discussed below: instructor's seat raised six inches to improve view; slats on the wings, moving through a 17-deg arc; a larger and higher-mounted tailplane to improve spin recovery; stronger undercarriage and extending nose leg for catapulting; a more powerful version of the J33 turbojet; naval equipment (including a deck-arrester hook) and a braking parachute; and considerable detail revision, particularly in the cockpit.

The engine is the 6,100 lb-thrust Allison J33-A-22 centrifugal turbojet. When boundary-layer control is required, compressed air is bled from the diffuser of the engine, ducted along a pipe inside the trailing edge of the wing and finally expelled at high

"Flight" photograph

FRESH START: First German-registered civil aircraft to visit England for nearly 16 years, this Convair 340 of Lufthansa made a proving flight from Hamburg to London on April 15th. Its fin carried the registration D-ACAD and the black, red and gold flag of Federal Germany. A crew portrait appears on page 536.

FROM ALL QUARTERS . . .

velocity over the flaps and ailerons. Clearly, this arrangement would be most useful in landing configuration with full flap, for ample compressed air would then be available to maintain laminar flow over the flaps and prevent breakaway. This would greatly increase the maximum lift and lift coefficient, and thus reduce the stalling speed. On the other hand, it would seem that overshoot action would greatly reduce the amount of air which could be bled from the engine, and special provision must be made to maintain lift with full flap when maximum forward thrust is required.

The system used was developed by Mr. John Attinello, and the U.S. Navy Bureau of Aeronautics, together with Allison division of General Motors and Grumman Aircraft Engineering Corpn.; it was first tried on an F9F-4 Panther carrier jet fighter (*Flight*, p. 712, November 12th, 1954).

As the T2V-1, the model 245 is now in large-scale production for the U.S. Navy. The T2Vs will be used principally to instruct pilots in deck landing, and the boundary-layer control will presumably be used simply to increase safety. Equipment standardized on the production T2V will include comprehensive radio and A.D.F.; glide-path receiver and V.O.R.-localizer attitude gyro; a combination gyro compass and homing device; instrumentation in which, by using selector switches, different navigational values can be read from single instrument faces; and an "inside windscreen" of laminated light alloy which is automatically erected by the canopy-jettisoning circuit to provide protection against the slipstream during the ejection sequence.

TEETH ON TEST: For many months Bristol B.E.25 components have been subjected to rigorous ground testing. This photograph, revealed in Dr. S. G. Hooker's paper read last Monday before the S.A.E. in New York, shows the B.E.25 reduction gear on endurance testing. Power is supplied by coupled Proteus units; 4,250 shaft h.p. was being transmitted at the time that the photograph was taken.

Rotor and Ring

RETROSPECTIVELY, the past twelve months seem to have introduced—albeit in rudimentary forms—an unprecedented number of curious types of flying machine. One of the strangest of all is the aerodynamic test vehicle illustrated on this page; it has been developed by Hiller Helicopters against a U.S. Navy Office of Naval Research contract.

The machine comprises an annular "wing" with no thickness (i.e. made from a single sheet) with an internal diameter of about five feet; a pair of contra-rotating rotors in the plane of the parallel-sided "skirt" of the annular wing and driven by a pair of vertically mounted flat-four piston engines reported to have a combined power of about 100 h.p.; a central platform for the pilot, with a tubular hand-hold structure carrying elementary controls and a single instrument; and four bungee-sprung legs attached to a girdle-ring surrounding the skirt of the annular wing and separated from it by a radial space of at least three inches. There may be control surfaces inside the annular wing.

The pilot climbs aboard *via* a portable ladder and stands approximately over the centre of gravity. Both engines are then opened up by means of a motor-cycle-type twist-grip throttle until, when the thrust is greater than the weight, the craft rises vertically. As it leaves the ground it may tend to tilt—say, to the right; the pilot then shifts his weight slightly to the left and restores equilibrium. This movement has been found to be instinctive, just as it is in normal walking. To go forward the

UPLIFT: Described here, the Hiller "Flying Platform" is here being flown at Palo Alto, California, by company test-pilot Phil Johnston.

pilot leans slightly forward, so tilting the axis of the craft and producing a forward component of lift. He can move in any direction merely by leaning or moving his body in that direction. We can only presume that the c. of g. is below the "centre of pressure."

The device illustrated is looked upon solely as a research tool, and not as a prototype aircraft. It has, in U.S. Navy words, "indicated that this principle has possible applications in larger vertical-flight aircraft." The comment is added that "further research and development will be necessary before these principles can be applied in the production of military aircraft."

Part of the lift, of course, comes from the downward acceleration of the air, and in this the device resembles a conventional helicopter. A proportion of the lift, however, must also accrue from the pressure reduction over the upper face of the annular wing. Thus, this machine should be more efficient than the unshrouded-rotor vehicle flown in New York State by Mr. Lewis McCarthy (illustrated on p. 378 of our March 25th issue). It is believed that the Hiller is the first ducted-fan aircraft—if it can be so termed—to have carried a human pilot; devices of the same type were flown, tethered, by the N.A.C.A. in 1952, one being illustrated on p. 418 of our issue of Sept. 10th last.

PASSING-OUT PARADE of No. 64 Entry at the Royal Air Force College, Cranwell. The reviewing officer—seen in the photograph on the right—was Air Chief Marshal Sir Arthur P. M. Sanders. Prizewinners are shown in the group above: (left to right, front rank) Sen. U/Off. J. N. Sawyer, F/Cdt. S. M. U. Situnayake, U/Off. J. F. Merry, Sen. U/Off. F. M. A. Hines, Sen. U/Off. D. N. Cousins. (Rear rank) F/Cdt. C. A. Herbert, F/Cdt. D. A. McArthur, U/Off. R. Horsfield. *Details of the awards appear on page 537.*

Silencing Jet Helicopters

IN a paper presented to the Helicopter Association on April 15th, Professor E. J. Richards, M.A., Professor of Aerodynamics, Southampton University, discussed the technical aspects of the problem of helicopter noise suppression.

After describing the experimental work which had already been carried out on piston-engined rotorcraft, he reached the conclusion that exhaust silencers could and should be fitted to future orthodox helicopters. He then passed on to the more difficult task of reducing the noise associated with jet-driven rotors.

A considerable number of experiments had been made, both by the National Physical Laboratory and Southampton University, as well as by the Fairey Aviation Company and Rolls-Royce. These had included the use of a variety of nozzle attachments designed to reduce combustion noise and decrease turbulence at the jet outlet.

As a result of these investigations, certain lines of development showed promise of providing some noise reduction. The most efficient device so far tested, a cross-tail silencing nozzle attached to the jet outlet, had been effective in reducing the noise level by approximately 9 decibels, but had caused a higher thrust loss than could be accepted for practical purposes.

For future development, a device to provide an annular jet at the blade tip had been designed, and it was expected that it could provide a reduction in overall noise of as much as 16 db with only a small thrust loss. Much work remained to be done but the problem was by no means insurmountable. We hope to publish a detailed account of the lecture in a forthcoming issue.

Blériot to Midge

OUR account of the A. and A.E.E. Contractors' Dinner last week intimated that A. Cdre. A. H. Wheeler, C.B.E., M.A., (Cantab.), then commanding the establishment, was about to retire from the R.A.F. Now a civilian, he has accepted an appointment as adviser to the Air Registration Board and will be available for private consultation also. He hopes, too, to devote more time to his duties as trustee of the Shuttleworth Collection.

Allen Wheeler was educated at Eton and Trinity College, Cambridge, and was commissioned in the R.A.F. in 1925. He flew Siskins with No. 111 Squadron and in the 1927 R.A.F. Display performed aerobatics with the late Alan Marsh. He attended an engineering course at the Home Aircraft Depot at Henlow, and after a second tour with No. 111 Squadron was posted to the R.A.F. Depot at Hinaidi, in charge of the engine shops. In 1930 he was appointed A.D.C. to the High Commissioner, Iraq, and later as personal assistant to A.V-M. Ludlow-Hewitt, A.O.C. Iraq. In the Middle East he designed and built his own light aircraft.

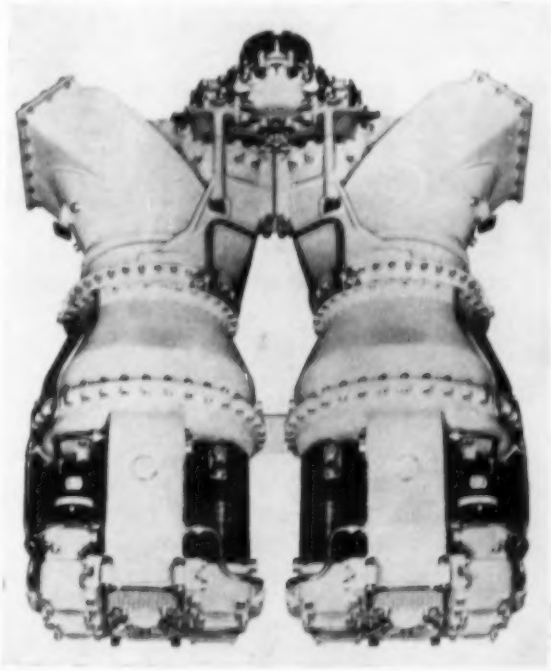
Back in England in 1932 he was posted again to Henlow; thence successively to No. 1 Squadron and to No. 41 Squadron. In 1935 he began another tour in the Middle East, commanding Hawker Demons at Aden. Throughout 1936 he was engineer staff officer at A.H.Q. Aden. Home again in 1937, he was attached to H.Q. Bomber Command, and in 1938 attended a course at the R.A.F. Staff College.

His next appointment was to No. 6 Group; then, in 1940, he took command of the Performance Testing Squadron at the A. and A.E.E. He was at that time a wing commander. From Boscombe he transferred to the R.A.E., as O.C. Experimental Flying, and for two years was intimately concerned with the development of gliders, with the testing of the Gloster E.28/39 (on which he performed the first aerobatics), and with trials of the first captured Fw 190. In 1944 he assumed command of R.A.F. Station Fairford, whence Stirlings with paratroops and gliders carried out operations including those of Arnhem and D-day.

The war nearly over, and with air commodore rank, he flew a Spitfire to India, whither he had been posted as S.A.S.O. B.A.F.S.E.A. Returning in 1946, he was posted to the Air Ministry as Deputy Director, Auxiliary and Reserve Forces, and subsequently commanded the Airborne Forces Experimental Establishment at Beaulieu, where he learned to fly helicopters. Early in 1949 he was appointed Commanding Officer of Experimental Flying at the R.A.E. for the second time, and in 1950 took over command in Cyprus. He returned to the United Kingdom in 1952 on appointment as Head of the Aeroplane and Armament Experimental Establishment.

He has, in all, flown 230 different types of aeroplane, from the veteran Blériot monoplane to modern transonic fighters such as the Hunter and Midge. During the Comet Inquiry A. Cdre. Wheeler was one of the three assessors to Lord Cohen, the other two being Sir William Farren and Professor Duncan.

TWIN TURMO: Now being intensively developed at Brough is the Blackburn-Turboméca Twin Turmo, a particularly neat source of approximately 900 s.h.p. Although no definite application has yet been announced, the Twin Turmo is almost certain to go into production for British helicopters. Main drive is at the turbine end.



HERE AND THERE

INTERCEPTER: This new in-flight view of the Convair F-102A supplements those published in our issue of January 14th of this year. Production F-102As now on the line at San Diego will serve with U.S.A.F. Air Defense Command, armed with six Hughes Falcon homing missiles.

Queen's Birthday Fly-past

FROM the balcony of Buckingham Palace the Queen will take the salute of a fly-past of R.A.F. aircraft on Thursday, June 9th, Her Majesty's official birthday.

Well-earned

ACCOMPANIED by Lady Churchill, Lord Cherwell and members of his staff, Sir Winston Churchill flew to Sicily on April 12th in B.E.A. Viscount G-AMOH *Harry Hudson*. The aircraft, which flew the standard of the Lord Warden of the Cinque Ports, covered the 1,267 miles from London to Catania in the record time of 3 hr 48 min. It was the first occasion on which a B.E.A. aircraft has flown a standard in honour of any passenger other than royalty.

Canada's New Tunnel

TO assist Canadian development of jet aircraft and guided missiles a wind tunnel, having a speed range of 200-3,000 m.p.h. and costing $3½ million, is to be built as part of the National Aeronautical Establishment at Uplands Airport. Created in 1951, the Establishment is financed by the Defence Research Board.

Soaring High

FLYING a Breguet 900 glider on April 14th, Rene Bransiart crossed the Alps at a height of 5,900 m (19,357ft). This is claimed as the first-ever glider flight over the Alps. Although he could have climbed higher, Bransiart decided against this as he had no oxygen or special clothing. Astonishingly enough, on the same day Miss Betsy Woodward soared to a height of 40,160ft over America's High Sierra mountains. Her flight had been sponsored by the U.S.A.F. Research Centre in connection with investigations of jet streams and high-altitude winds. Over the same mountains Dr. Joachim Kuettner, director of the U.S.A.F. Research Centre, has reached 43,000ft in a single-seat Schweitzer. This is said to have been 800ft above the record height reached by Bill Evans, of San Diego, in 1950.

Beating the Bottlenecks

THE congestion along Route A4, from Maidenhead to the Bath Road, by way of London Airport, is no worry to Mr. Richard Fairey, general manager of the Fairey Aviation Co., Ltd., and eldest son of Sir Richard Fairey. At his home at Maidenhead he steps into the ex-*Evening Standard* Sikorsky S-51, now owned by his company, proceeds along the route at some 85 m.p.h. and alights 10½ minutes later on a small area inside the precincts of the factory. Mr. Fairey is almost certainly the only director in the United Kingdom to use a helicopter for business travel; he went solo last October after only 1 hr 40 min instruction, and his experience should be of very great value when Fairey's Rotodyne 40/50-seater and the two-seater ultra-light helicopter are flying later this year.

For Easy Spotting

AMERICA'S Civil Aeronautics Administration has requested the opinion of aircraft owners concerning a proposed new system which would eliminate identification markings on the wings of aircraft, but would require numbers at least 12in high on the side of the fuselage or tail, for easier checking by investigating intercepters.

Five Grand

EARLIER this month it was announced by the Curtiss-Wright Corporation that more than 5,000 J65 turbojets had been delivered to the U.S.A.F. and U.S.N. The J65, which is derived from the Armstrong Siddeley Sapphire, is built by the Wright Aeronautical division in New Jersey state, and also by the Buick division of General Motors in Michigan. An increasing proportion of the J65 deliveries have afterburners.

SUCTION IN SERVICE: As described on page 509, the new Lockheed T2V-1 trainer for the U.S. Navy employs boundary-layer control. This reduces the unaccelerated full-load stalling speed to rather less than 100 m.p.h.; the maximum level speed is 600 m.p.h. In the background is the earlier TV-2 (U.S.N. version of the T-33A).

Britannia Parts By Air

FUSELAGE stringers for the Britannia 250 L.R. production line at Short and Harlands' Belfast works have been delivered from Bristol by a Freighter of Silver City Airways. The stringers are nearly 10 yards long and had been found difficult to pack for surface transport. Three Britannia 250 L.R.s have been ordered by the Ministry of Supply for trooping duties, and the Bristol Aeroplane Company are laying down a further five in anticipation of future demand. Mk 300s are also on order.

Pensioned Off

WHEN the Walt Disney Elementary School at Tullytown, Pennsylvania, opened last Monday, a Douglas Skyrocket was already established there as a playground toy. It is one of the second batch of machines from which the turbojets were removed to allow increased rocket tankage; this particular machine once reached a height of 13 miles. It seems strange that so advanced an airframe—though no doubt unairworthy—should thus be virtually scrapped.

MIXED POWER

Engines of Different Species in Combination: Mr. M. J. Brennan's R.Ae.S. Lecture

THE chief designer of Saunders-Roe, Ltd., Mr. M. J. Brennan, B.Sc., M.I.Mech.E., F.R.Ae.S., gave a Royal Aeronautical Society "main" lecture before the Glasgow Branch on April 14th. Entitled *Mixed Power Units in Modern Aircraft*, his paper outlined the propulsion requirements of various types of aircraft, discussed the manner in which these had been met in the past, reviewed the basic characteristics of a variety of types of aero engine and concluded by studying in some detail the problems posed by three widely differing types of military aircraft: the long-range jet bomber, the helicopter, and the supersonic intercepter.

Taking a broad view of the whole field of providing power for aircraft propulsion, Mr. Brennan pointed out that one of the most significant features was the variety of basically different units now available to designers. For fighters, the liquid-cooled piston-engine had almost completely given way to the turbojet, although the air-cooled engine was still widely used in all types of aircraft. Reference had also to be made to the American Wright Turbo-Compound and the Napier Nomad, the latter a compound diesel engine with a phenomenally low specific consumption. The lecturer then outlined the various developments of gas turbines since the introduction of the simple turbojet in the early 1940s. Today, this already wide variety of engines was being supplemented by the ramjet, the pulse-jet and the rocket.

From the point of view of the aircraft designer the most significant characteristics of a powerplant were its specific weight (installed weight divided by thrust or horsepower), the specific fuel consumption (fuel burnt per lb-thrust or h.p. per hour) and specific frontal area (frontal area divided by h.p. or thrust). All three of these qualities, clearly, varied according to flight speed and altitude. Another complicating factor was that the output of piston engines was measured in horsepower whereas thrust was the criterion in all jet-propulsion engines; thrust could be approximately converted to horsepower by multiplying by $V/300$,* where V was true airspeed in m.p.h. Typical examples [shown on the following pages] of these three basic characteristics had been drawn for each basic type of aero engine. They were, said Mr. Brennan, applicable to reasonably modern units, although the quantitative data were very general and in some cases possibly pessimistic. The lecturer went on to outline the salient features of each figure; generally speaking, it was always possible to achieve higher specific output at the expense of efficiency and, conversely, higher efficiency at the expense of an increase in complexity.

If each particular type of aircraft had to meet the needs of only one condition of flight—as far as the power requirement was concerned—there would be only one choice of powerplant for the optimum design. In practice, of course, every aircraft had to meet both take-off and powered flight conditions, and the latter might in addition be broken down into several phases requiring differing or conflicting types of power. The remainder of Mr. Brennan's lecture was devoted to an examination of the power requirements of the three types of military aircraft already mentioned.

The Long-Range Bomber.—The principal flight conditions to be satisfied by the power units were, in this case, the take-off and the maximum-range cruise; there was, however, a tendency to sacrifice range to gain cruising speed, so variation of the two latter parameters had been considered. It could be shown that the range was equal to

$$\text{range} = \int v\,dt = \frac{L}{D}\,\frac{V}{c}\int\frac{dW}{W}$$

where L = lift, D = drag, V = t.a.s., c = specific consumption and W = weight. It could be seen that for any given full load the only variables were V,L/D and c. It could be shown that the maximum range which could be attained by a typical jet bomber (in which the weight of basic aircraft, engines and fuel was a fixed proportion of take-off weight), reached a maximum at a cruising Mach number of slightly over 0.9, dropped rapidly to less than half this peak as soon as Mach 1 was exceeded, and then rose again almost to its former maximum at a cruising Mach number of about 2.5.

The trend of development was still towards ever-higher thrust/weight ratios and higher take-off wing loadings. Generally speaking, an increase of 10 per cent in take-off weight allowed an increase in maximum range of some 8 per cent; the take-off weight was normally limited by the take-off speed, and this well-known design procedure applied with equal force to supersonic aircraft, since it could reasonably be expected that the high thrust required for supersonic flight would ease the take-off case. It could be remarked that it might be desirable to design for a cruising Mach number as high as six, and rough calculations indicated that an optimum range of 2,500 nautical miles might be achieved with this sort of performance using ramjet power. Consequently, if it was again found desirable to sacrifice range for speed, future bombers might be powered by a mixture of

**Allowing for airscrew η = 82 per cent.*

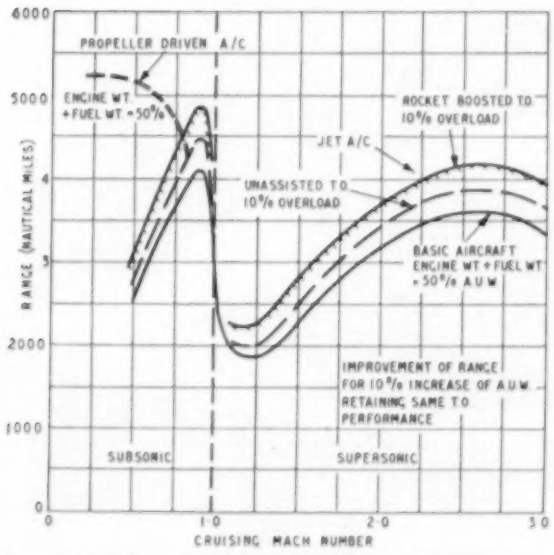


Fig. 1. Variation of range with Mach number for turbojet and airscrew-driven aircraft. The basic aircraft in each case is assumed to carry an engine-plus-fuel weight equal to half the all-up weight.

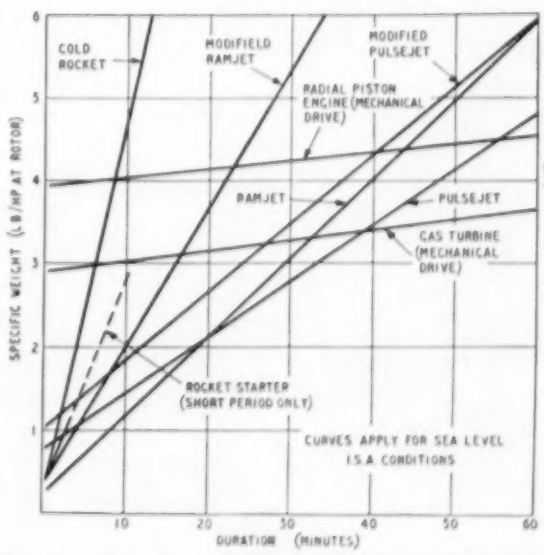


Fig. 2 (right). Characteristics of helicopter propulsive systems.

MIXED POWER . . .

turbojets and ramjets, or possibly by one of rockets and ramjets.

Helicopters.—In level flight the helicopter required power for accelerating the air downwards through the rotor and hence providing lift, for rotating the blades and for overcoming the drag of the fuselage in forward flight. The first requirement decreased with forward speed; the second increased steadily; and the last-named increased as the cube of forward speed and became predominant at high speed. It was, therefore, essential to consider the possible roles of a particular aircraft before discussing the best powerplant arrangement.

The most important parameters were the maximum cruising speed required and the ratio of hovering to total flight time. The need for safety in an "engine cut" case was also important, particularly with larger helicopters.

The lecturer illustrated a hypothetical medium-size machine driven in forward flight by a gas turbine/airscrew unit and with hovering power augmented by modified pulse-jet units at the blade-tips. Assuming that, for the role envisaged, the aircraft was not required to cruise faster than 85 knots, the cruise power required from the turbines was some 70 per cent of that required for hovering. An additional 45 per cent was needed for a vertical 600 ft/min climb (to a total of 115 per cent of the hovering power).

In some cases, if the specific weights of various combinations of power unit were plotted against proportionate hovering time a "break-even" boundary was manifest below which it was advantageous to employ mixed pulse-jet and turbine power. In fact, said Mr. Brennan, in investigating the field of helicopter requirements one was impressed with the necessity of mixing the powerplant in most cases.

The Intercepter.—This was perhaps the most colourful example of mixed powerplant in aircraft. It inevitably involved the combination of the turbojet and the variable-thrust rocket.

Faster bombers implied higher cruising altitudes, and this combination increased the demands on the intercepter, for the latter had to climb higher and faster in less time. Consideration of a typical interception showed that steady flight at a high Mach number, and definite specified durations, were only part of the whole; the required flight plan was tending to become more and more a continuous manœuvre involving large accelerations. It was at first thought that the afterburning turbojet would meet requirements, but this was being precluded by the necessity of manœuvring at high altitude. At 50,000ft, for example, a turbojet gave only some 20 per cent of its sea-level thrust, whereas the thrust of the liquid rocket actually improved slightly with altitude and its specific weight at 50,000ft was approximately 1/10 of that of the afterburning turbojet.

The take-off posed no power problem, since the thrust required in the air was ample for becoming airborne. If the climb was made on the turbojet alone it was undoubtedly cheaper (in overall weight of engine-plus-fuel) to employ the maximum size of engine capable of meeting the take-off requirement. But interception procedures required the maximum possible rate of climb. Fig. 4 shows the weight of engine-plus-fuel necessary to reach 50,000ft in any given time. It could be seen that the simple turbojet rapidly approached the total weight of the rocket motor plus fuel as the required time-to-height was reduced. By using the turbojet alone up to the point at which rate of climb began to deteriorate seriously, and then firing the rocket, the time-to-height could be reduced for a total powerplant weight below that of either the turbojet or rocket. Thus in the climb it was more economical (from the point of view of weight) to employ mixed power; on the other hand, some intercepters were not required to have the

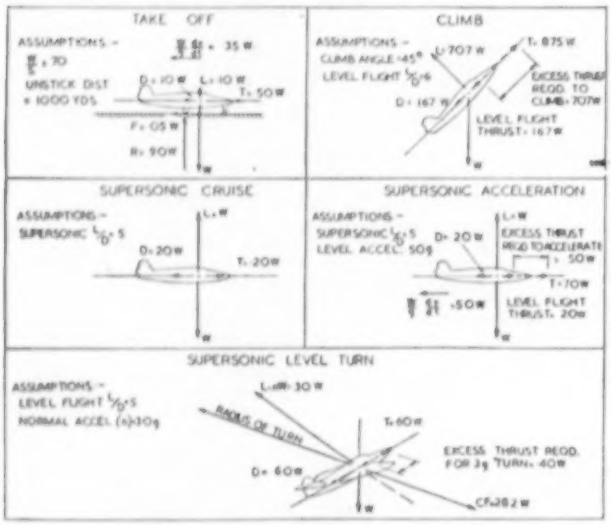


Fig. 3. Typical forces and thrust requirements for an intercepter.

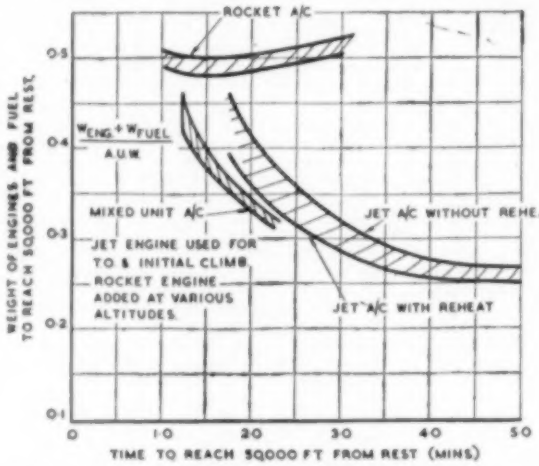

ROCKET A/C
MIXED UNIT A/C
JET A/C WITHOUT REHEAT
JET ENGINE USED FOR TO ⅓ INITIAL CLIMB
ROCKET ENGINE ADDED AT VARIOUS ALTITUDES
JET A/C WITH REHEAT
WEIGHT OF ENGINES AND FUEL TO REACH 50000 FT FROM REST
TIME TO REACH 50000 FT FROM REST (MINS)

Fig. 4. Intercepter take-off and climb: engine-plus-fuel weight required to reach 50,000ft in specified times.

Fig. 5 (below). Cruise durations at which the engine-plus-fuel weight for an afterburning turbojet and a rocket are equal.

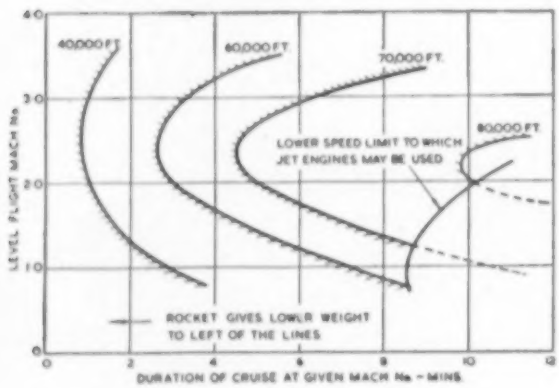
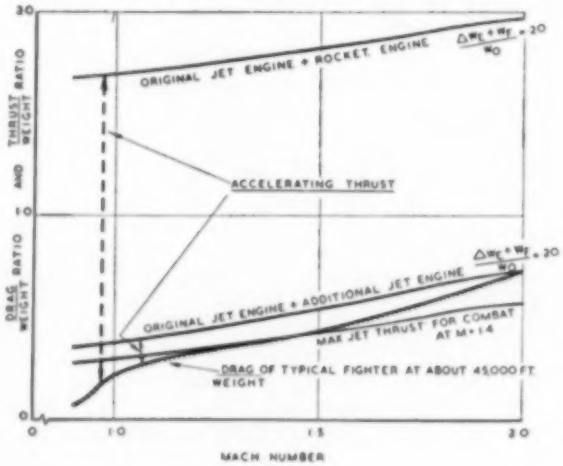

40,000 FT
60,000 FT
70,000 FT
80,000 FT
LOWER SPEED LIMIT TO WHICH JET ENGINES MAY BE USED
ROCKET GIVES LOWER WEIGHT TO LEFT OF THE LINES
LEVEL FLIGHT MACH No.
DURATION OF CRUISE AT GIVEN MACH No. – MINS.

Fig. 6 (below). Supersonic acceleration: illustrating the great reserve of thrust offered by the rocket at high altitude, available for acceleration.

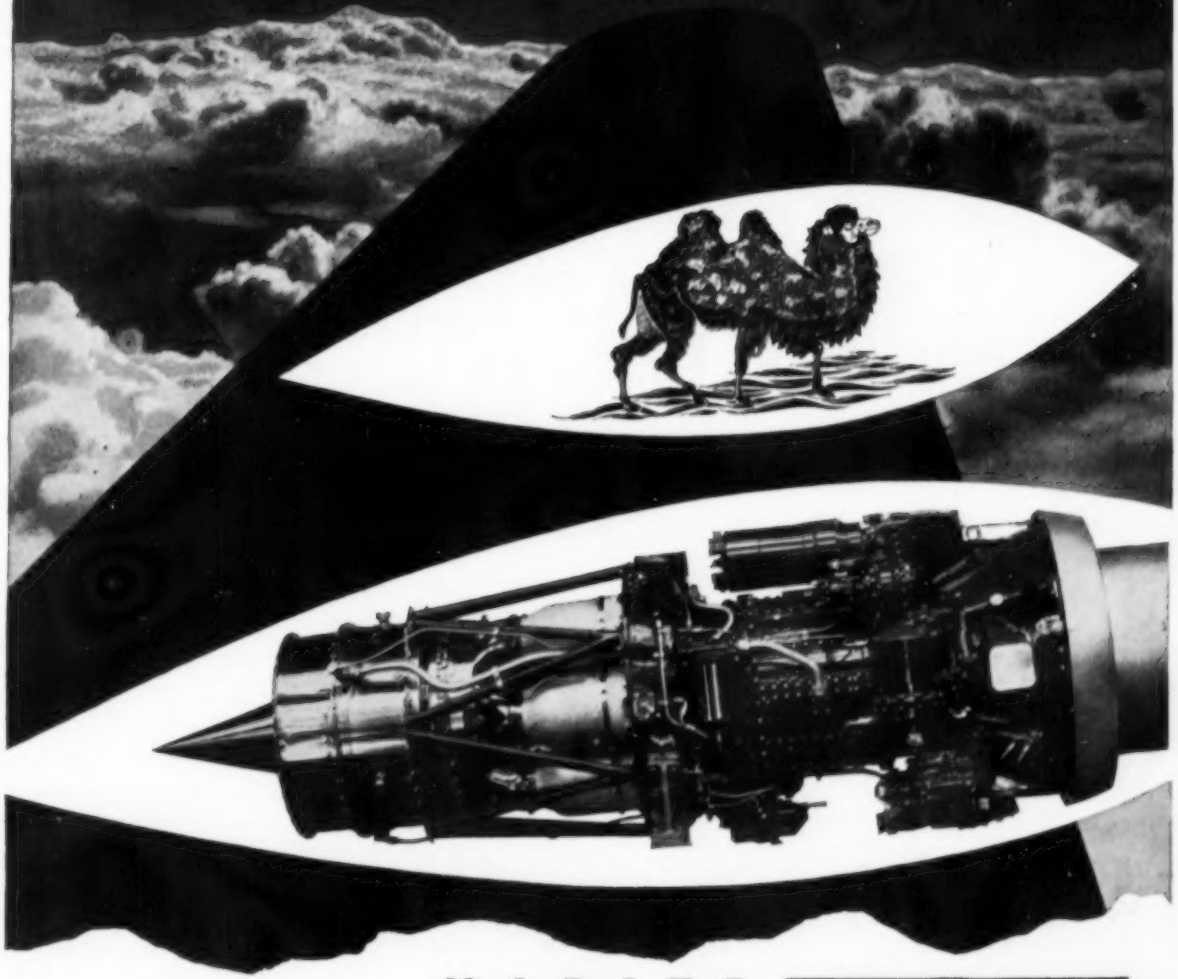

ORIGINAL JET ENGINE + ROCKET ENGINE
ACCELERATING THRUST
ORIGINAL JET ENGINE + ADDITIONAL JET ENGINE
MAX JET THRUST FOR COMBAT AT M = 1·4
DRAG OF TYPICAL FIGHTER AT ABOUT 45,000 FT WEIGHT
THRUST RATIO AND WEIGHT RATIO
DRAG WEIGHT RATIO
MACH NUMBER

low fuel consumption

Specific fuel consumption of the Napier Eland propeller-turbine is very low indeed—0.450 lbs./e.h.p./hr. at 36,000 ft. 400 knots cruising, or 0.505 lbs./e.h.p./hr. at 20,000 ft. 350 knots cruising. This means a great deal to the operator in terms of payload, performance and direct operating cost.

more facts about the Eland

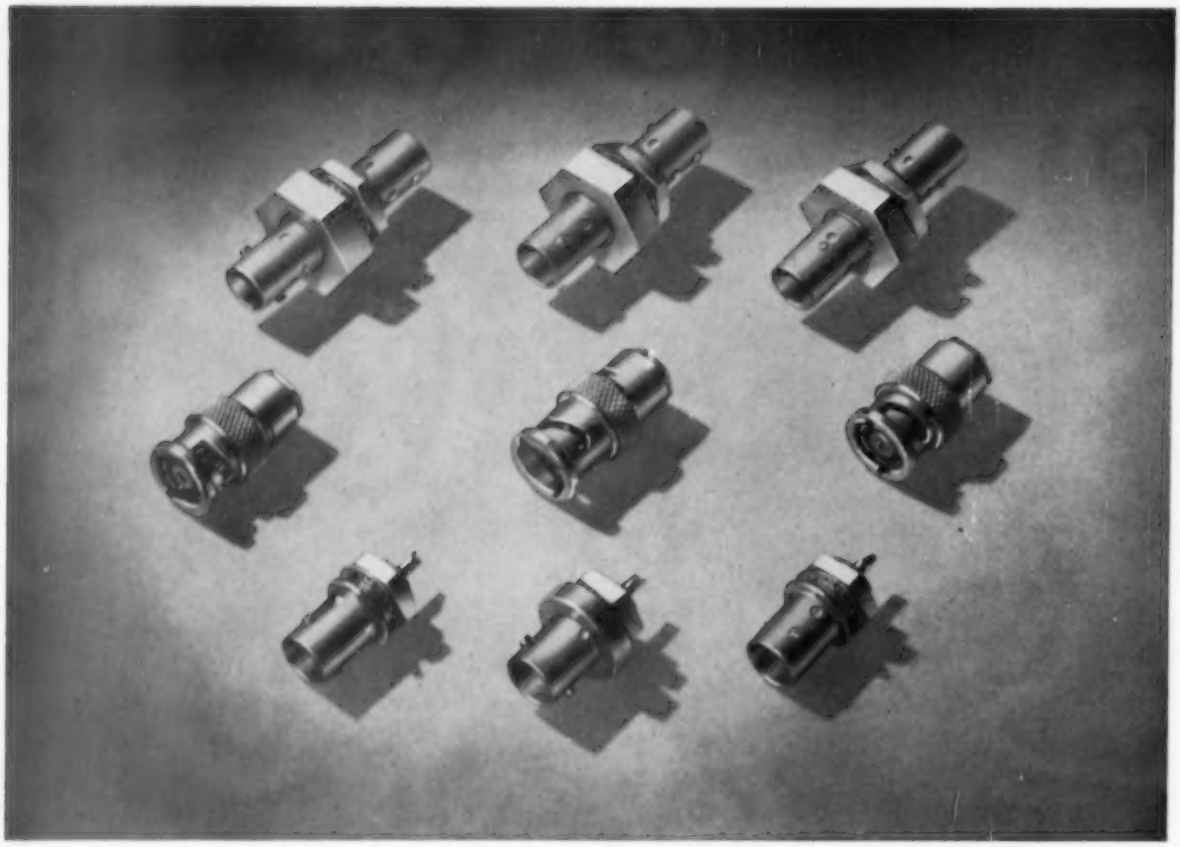
* High aerodynamic efficiency—3,000 e.h.p. in a maximum diameter of 36 inches.
* Low specific weight—0.52 lbs./e.h.p.
* Easy maintenance—independent unit construction.
* Ease of control—single lever control, with manual over-ride, guards against engine over-speeding and over-fuelling.
* Automatic temperature compensation.
* At the first attempt the Eland has recently passed a 150 hour type test rehearsal at the full 3,000 e.h.p. rating.



NAPIER Eland turbo-prop

D. NAPIER AND SON LIMITED · LONDON · W.3

CRC 618



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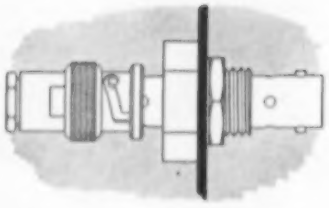

- ★ All connectors are silver plated and will operate in temperatures up to 250°C.
- ★ P.T.F.E. insulation.
- ★ Practical frequency limit—10,000 m/cs.
- ★ Voltage standing wave ratio—less than 1.35:1 in a 50 ohms system.
- ★ Maximum voltage—500 volts.
- ★ Current carrying capacity—1 amp.
- ★ Interchangeable with BNC equivalent types.
- ★ Can be supplied for variations in cable diameters.

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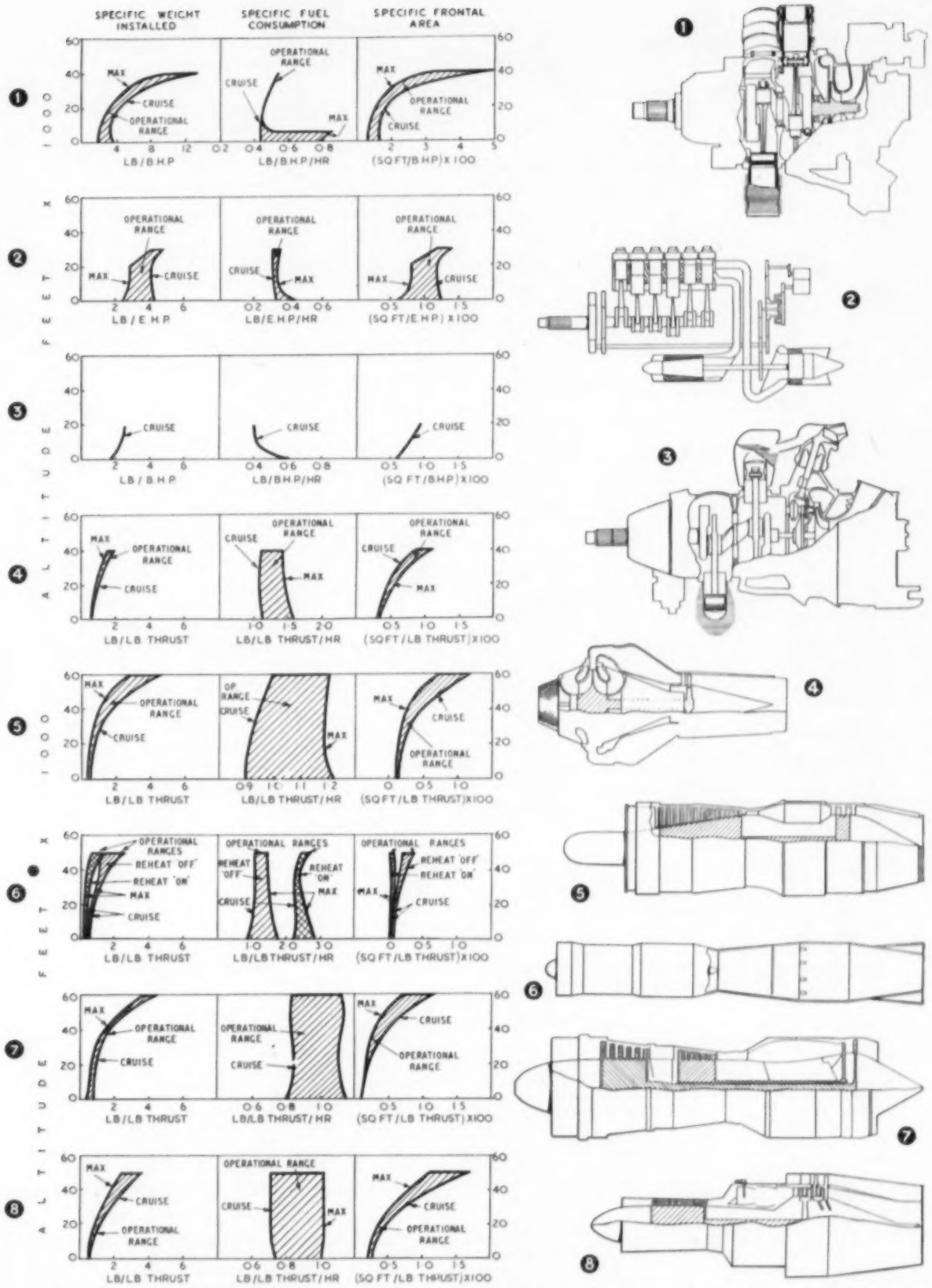
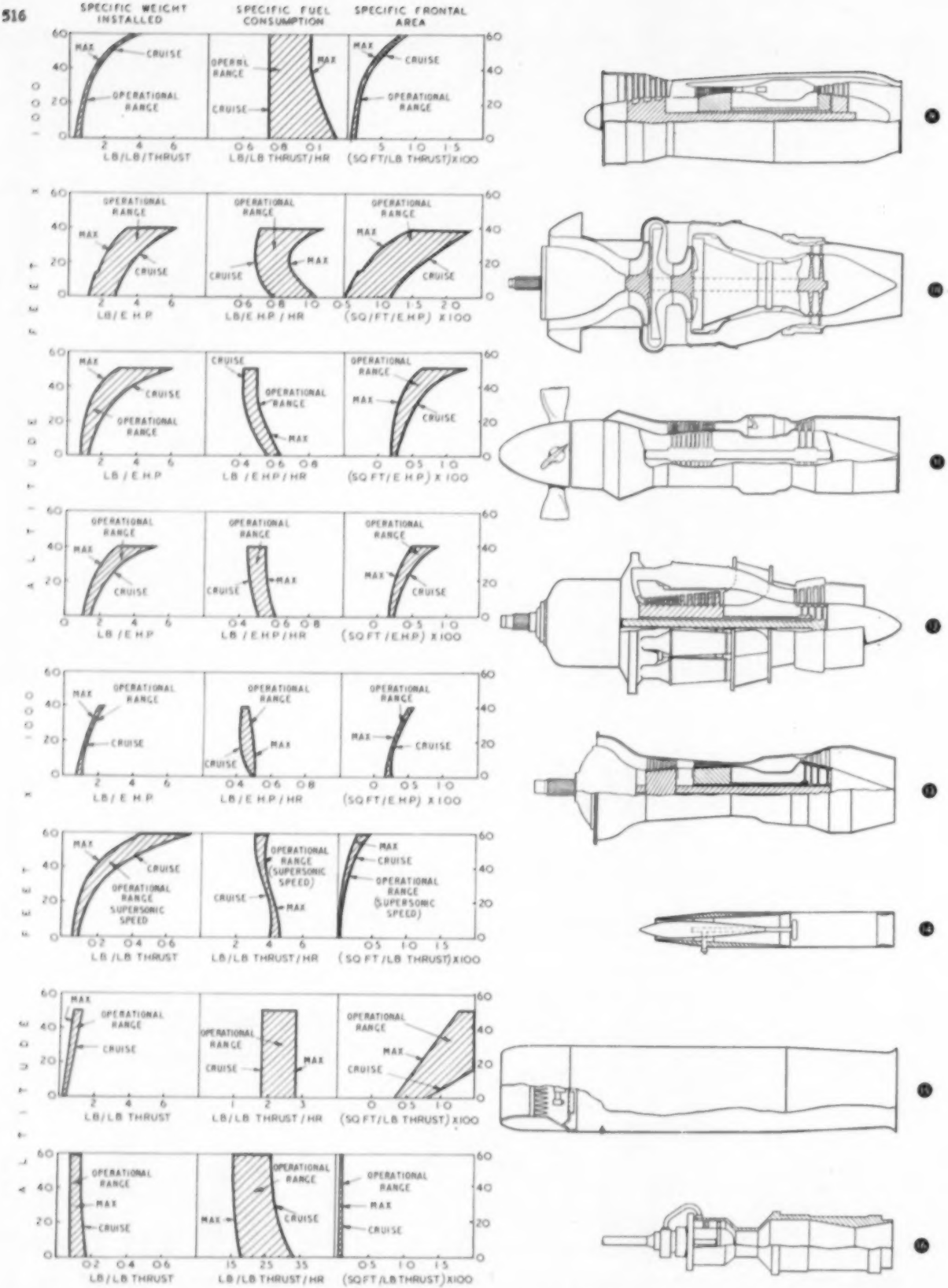


MIXED POWER, *Fig. 7. Characteristics of various types of aircraft engine, showing typical values of installed specific weight (lb/h.p. or lb/lb thrust), specific fuel consumption (lb/hr/lb thrust or h.p.) and frontal area in sq ft per h.p. or lb thrust. The engines are: 1, two-row, supercharged, air-cooled radial; 2, Napier Nomad compound diesel; 3, Turbo-Compound petrol engine with blow-down power-recovery turbines; 4, simple centrifugal turbojet; 5, simple axial turbojet; 6, axial turbojet with reheat (i.e., with afterburner); 7, two-spool or split-compressor turbojet; and 8, ducted-fan engine. Readers may like to identify each of the "typical" engines selected.*



MIXED POWER, *Fig. 8. Further types of aero-engine characteristics: 1, by-pass turbojet, or turbofan; 2, two-stage centrifugal turboprop; 3, single-shaft axial turboprop; 4, free-turbine turboprop; 5, split-compressor turboprop; 6, supersonic ramjet; 7, pulse-jet; and liquid rocket motor.*

MIXED POWER . . .

highest rates of climb, and in such cases rocket fuel could be conserved for extended combat.

A further advantage of the mixed-power intercepter was that, although the sum of the weight of mixed engines plus fuel was less than that for the pure-jet aircraft, the aircraft used more fuel in the climb. Thus the mixed-power aircraft arrived at altitude with a lower wing-loading, and this had an important influence on manœuvrability.

The next diagram (Fig. 5) illustrated the break-even times when the engine-and-fuel weight for given running times were equal; this approach was put forward by Prof. Baxter in his lecture on rocket propulsion [summarized in *Flight* of February 18th]. However, the interpretation of this diagram became rather difficult where a turbojet was already installed for take-off and climb purposes.

It could be assumed that the existing turbojet was capable of propelling aircraft at M = 1.0 and that it was required to increase this flight speed to M = 2.0 at 60,000ft. Then, if the duration required at M = 2.0 was less than three minutes, it was best to use an additional rocket motor, since the weight of additional turbojet and fuel to provide the extra thrust was more than the weight of the corresponding rocket plus fuel. This was not the complete story, because the aircraft had to accelerate from M = 1 to M = 2 and it was in accelerated flight that the rocket was particularly superior. The weight of additional turbojet power would accelerate the aircraft to M = 2 in 10 min whereas the same weight of additional rocket thrust could do this in one minute or less.

The necessity of accelerating to combat speed in the minimum time was of the greatest importance in an interception. The shapes of the aircraft total-drag curves and turbojet thrust curves were shown in the next illustration (Fig. 6); it could be observed how nearly parallel they were. Theoretically, a high Mach number was possible on turbojet power alone, but the accelerating forces were small; the diagram showed that the aircraft should attain M = 1.4 at about 45,000ft. Suppose that M = 2 had to be reached and that a turbojet or rocket was to be added to produce the required acceleration, the added weight of engine fuel being 1/5 of the take-off weight: the great differences in acceleration could clearly be seen and the variation in time required to reach the required Mach number was important enough to warrant a different approach. The diagram in col. 2 (Fig. 9) showed the picture from a different point of view. Here, the sum of the added engine-plus-fuel weight to accelerate the aircraft from M = 1 to M = 2 was plotted against the time taken. This showed immediately that the rocket had to be employed if high acceleration was desired.

At some time during the interception it was necessary to complete at least part of a turn before levelling up for the attack. The thrust requirements for the turn were not simply related to the

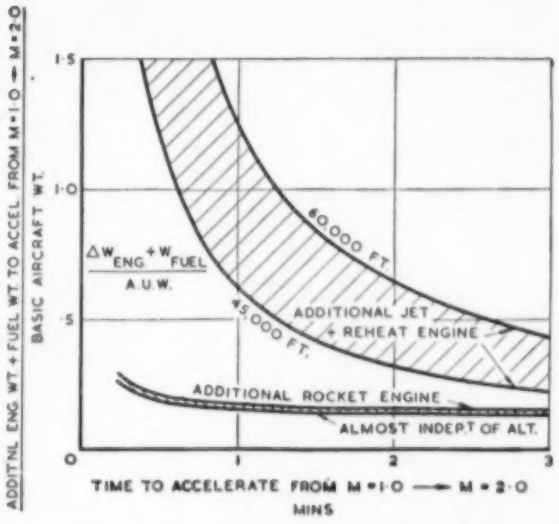


Fig. 9. Supersonic acceleration: illustrating the extra engine-plus-fuel weight required to accelerate an intercepter from Mach 1.0 to Mach 2.0 in specified times.

acceleration; in most high-altitude turns the induced drag was roughly five per cent of the aircraft weight and therefore the incremental thrust/weight ratio required for longitudinal acceleration would be 0.05 (n^2-1), where n was the normal acceleration. Thus, putting n = 3.0 (3g), $\Delta T/w$ became equal to 0.4.

Returning to Fig. 6, it could be seen that, in order to obtain such performance, a turbojet would have to weigh considerably more than 1/5 of the aircraft weight; additional turbojet power equivalent to 1/5 of the aircraft weight could give a normal acceleration of only 1.4g compared with a typical requirement of approximately 3g.

In all the manœuvrability cases considered in the paper it was shown that the use of a rocket rather than additional turbojet power resulted in a lower total weight of engine-plus-fuel. On the other hand, it was still necessary to consider the take-off and steady cruising conditions, and the superiority of the turbojet at lower altitude and for continuous cruising for periods longer than 10 min made it an ideal choice in combination with a rocket.

COUNTER ALTIMETER FOR U.S. NAVY

AN American company, the Kollsman Instrument Corporation, has received an initial production order from the U.S. Navy for a new counter altimeter. The principle is not altogether new, but an instrument of this kind has long been sought after as a replacement for the present sensitive altimeter for jet aircraft.

The new instrument indicates thousands of feet on a Veeder-type counter, there being also a single needle which travels one thousand feet per revolution. It is therefore no longer possible for the pilot to confuse the readings of three different needles.

The great problem in adapting Veeder-type indications to pressure altimeters is to eliminate sensitivity-limiting friction in the counter linkage. This Kollsman claim to have achieved. The original idea of a counter altimeter is stated to have originated from Dr. W. F. Grether of the U.S.A.F. Aero-medical Laboratory.

Special balance-weight arrangements have been provided in the new instrument to compensate for g effects during manœuvre, and temperature compensation for from 160 deg F to −60 deg F has been incorporated. The cost of the instrument is said to be well within the range of present prices for such equipment.

AIRSTOPS IN THE NEWS

REGULAR readers of *Flight* will recall that on a number of occasions we have referred, in leading articles and elsewhere, to the need for Britain's cities and towns to plan helicopter sites, or at least to reserve space for them. It may also be remembered that in our December 10th, 1954, issue we reported a speech by Mr. H. T. Hough, Liverpool's city engineer and surveyor, in which he described preparations made by his own city for establishing airstops and also put forward some sound views on the question in general.

That local authorities are showing a very real interest in this question is shown by the number of enquiries for information that *Flight* receives. The Aerodrome Owners Association is experiencing a similar reaction, especially following its decision to devote a day of its 1954 annual conference to demonstrations and discussions of helicopter landing facilities. At these demonstrations, it will be remembered, experimental landings were made by Westland and Bristol helicopters at a site within 1,000 yards of Northampton's Guildhall.

Since that time, says the A.O.A., the volume of inquiries received has been so large that it has been decided to inaugurate a new grade of associate membership at a reduced subscription of £10 per annum. The Association gives the following list of cities and towns "which have already signified their intention to be prepared for the helicopter age by applying for A.O.A. membership": Barnsley, Barrow-in-Furness, Bath, Birkenhead, Blackburn, Bournemouth, Burnley, Folkestone, Glasgow, Halifax, Harrogate, Huddersfield, Kettering, Leicester, Macclesfield, Middlesbrough, Northampton, Oldham, Rotherham, Southampton, Southport, Sunderland, Tynemouth, Wallasey.

MR. N. F. NEWBERY

WE regret to record the death on March 26th, after a short illness—of Mr. Norman Francis Newbery, A.F.R.Ae.S., chief development engineer of B.O.A.C. Mr. Newbery, who was 38, began his aviation career as a ground engineer with the Cinque Ports Flying Club in 1936. After a short period with the de Havilland Airscrew Service Department he joined British Airways in 1939, subsequently holding a series of senior posts in connection with the maintenance of B.O.A.C.'s Boeing 314s, Liberators, Constellations, Super Constellations and Stratocruisers. Mr. Newberry assumed his last appointment in 1952.

The upper photograph, taken at Schiphol, shows a Schelde-built Saab Safir used by Lufthansa for general pilot-training. The U.S. Navy fighter is a Douglas F4D-1 Skyray (Pratt and Whitney J57 with afterburner), of which a squadron is now forming at a shore base.

AIRCRAFT INTELLIGENCE

Great Britain

Hunting Percival Jet Provost. The present batch of these aircraft are officially designated Jet Provost T.1, and have the company designation P.84. Several have now flown, and modifications introduced since the first machine was built include: a revised fuel system; provision for wing-tip fuel tanks at customer request (this installation was tested on a Provost); a revised jet-pipe nozzle and rear fuselage shape; and additional area added to the wing in the form of swept-forward leading-edge roots. Provision is also made for two nose-mounted 0.303in guns and underwing stores. Flight trials, both from Luton and Boscombe Down, are reported to have been very encouraging.

Canada

Avro CF-105. The twin Super Orenda PS-113 turbojets of this forthcoming all-weather, delta-winged intercepter will be up-rated from about 18,000 to 25,000 lb each, by the addition of specially developed Marquardt lightweight afterburners (quote from *Aviation Week*).

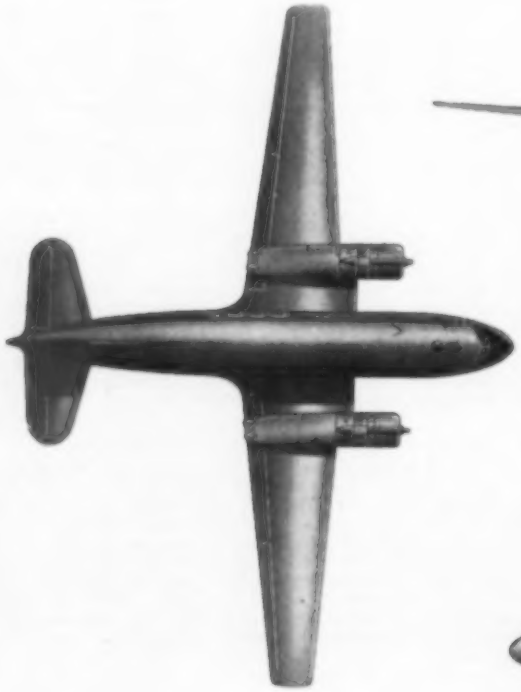
D.H.C. Twin-engined transport. The Canadian journal *Aircraft* has reported that de Havilland Canada are considering the development of a twin-engined "bush transport," in the class of the Twin Pioneer. The French *Aviation Magazine* calls it a "Twin Beaver," but it will probably be a good deal larger than the Beaver.

U.S.A.

Lockheed F-104. One more fact about this missile-like fighter has emerged in the American Press: it has a "T-tail," i.e. the horizontal tail surface is mounted on top of the fin. The afterburning J65 Sapphire turbojet showed up well recently when, during air-firing trials with the second (armed) YF-104, a shell link struck the inside of one intake wall. The link went through the wall and punctured a fuselage tank, causing neat fuel to pour into the engine, but the Sapphire kept running. Several developments of the F-104 are at present projected, including: the TF-104, a tandem-seat dual-control trainer; an all-weather version with "capability of carrying two-man crew"; and a Mach 2-plus machine powered by the 15,000 lb-thrust G.E. J79 turbojet.

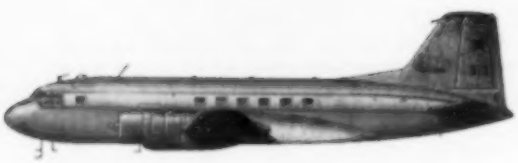
Piasecki H-16. The second prototype H-16 Transporter is designated YH-16A, and is powered with two Allison T38 turbines of some 2,450 s.h.p. each. This engine never went into production. If ordered in quantity, the turbine-driven H-16 would be powered by 3,400 s.h.p. engines based on the T56 or (commercial) Model 501. Designation would be H-16B.

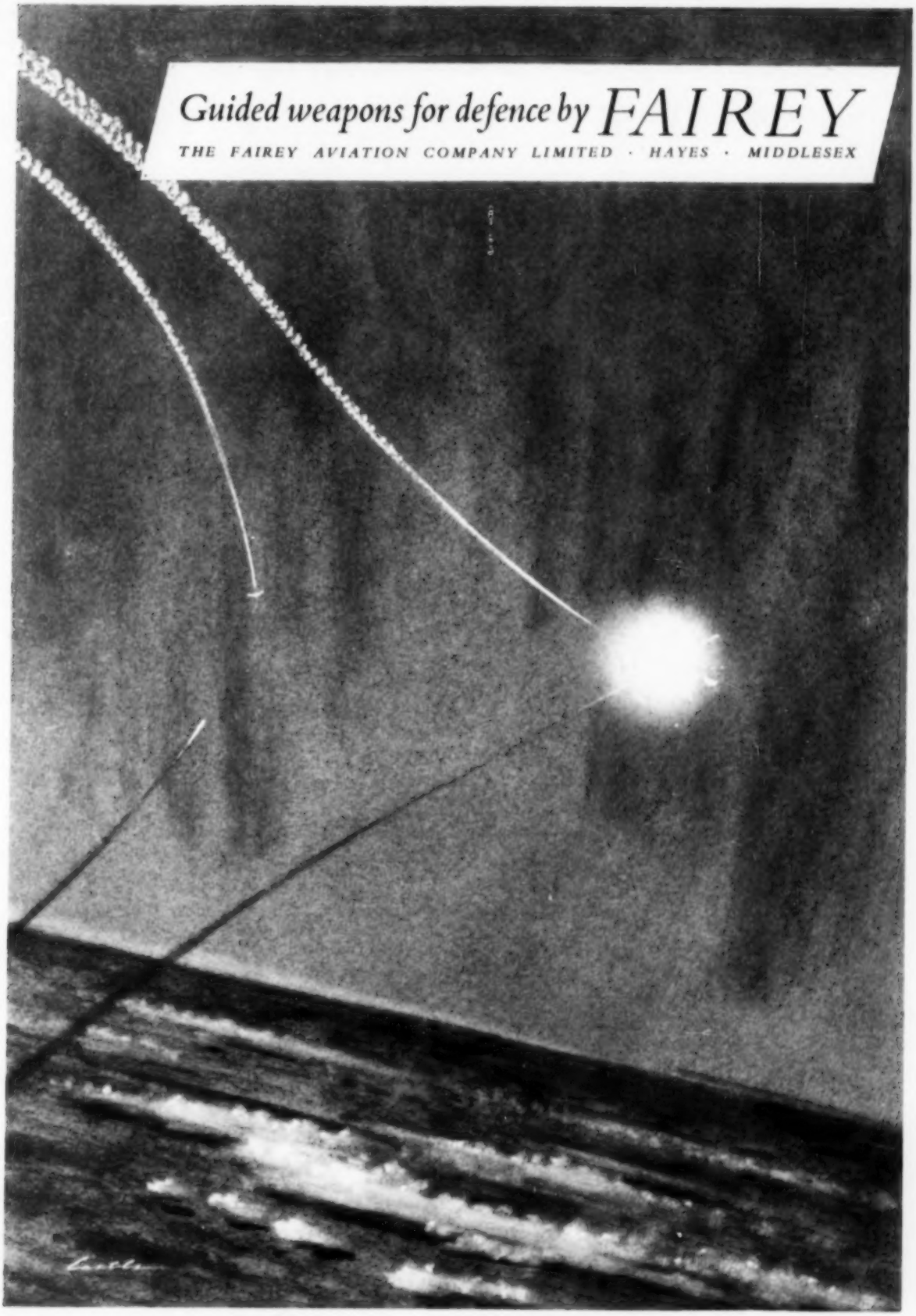
Republic XF-103. It is reported that this advanced aircraft will incorporate a periscope to enable the pilot to obtain adequate vision from his flush-hooded cockpit. The F-103 is a delta-winged intercepter, and was reported in 1952 to be designed for a Mach number considerably greater than two. The power is reported to come from a Wright J67 (Olympus development) turbojet and a ramjet, both fed from a common intake system fitted with doors to pass air to the turbojet during take-off and to the ramjet at supersonic speed.



Il-14
(1,840 h.p. ASh-82 radials)

Span	...	...	about 101ft
Length	...	...	about 70ft

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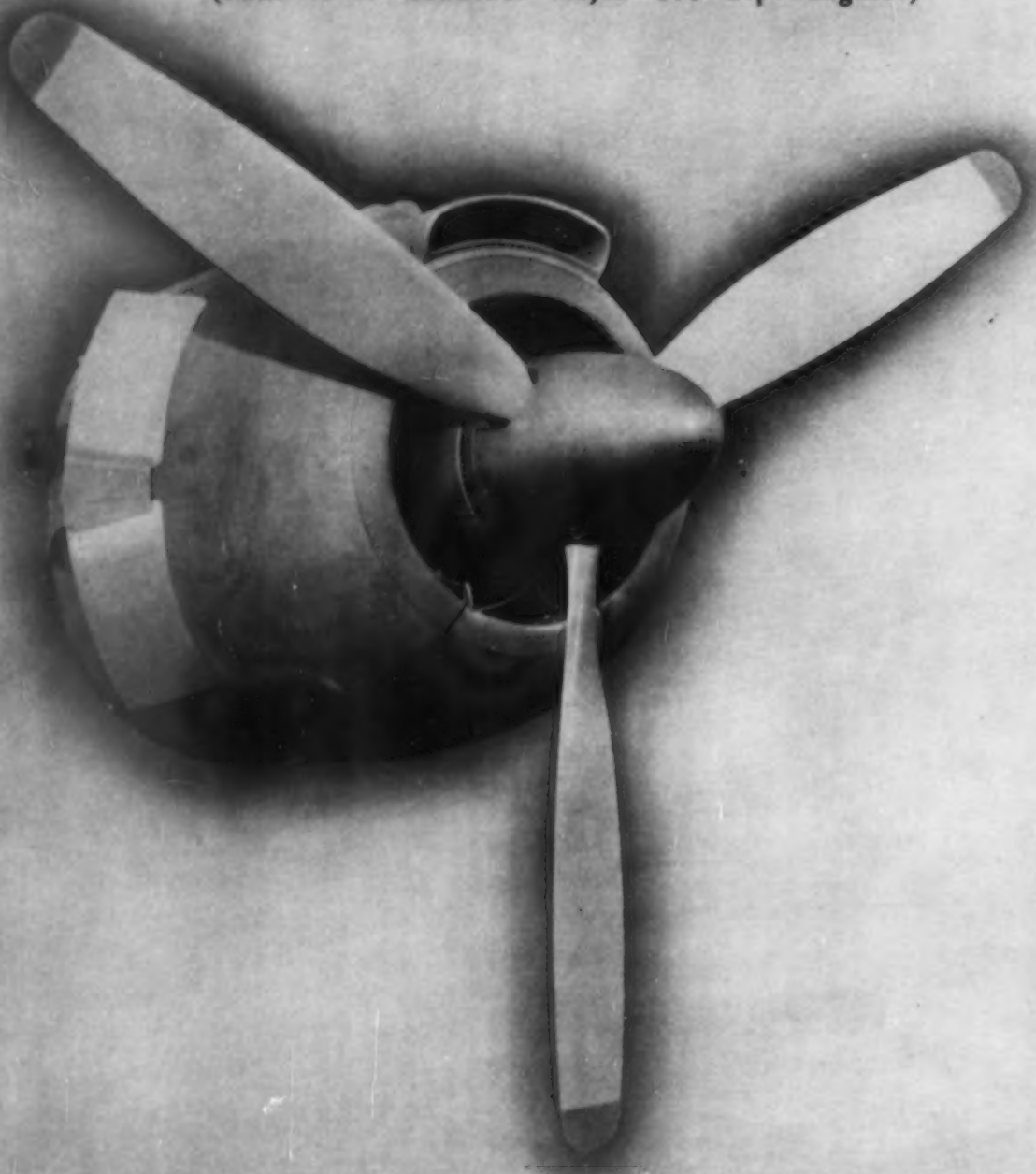

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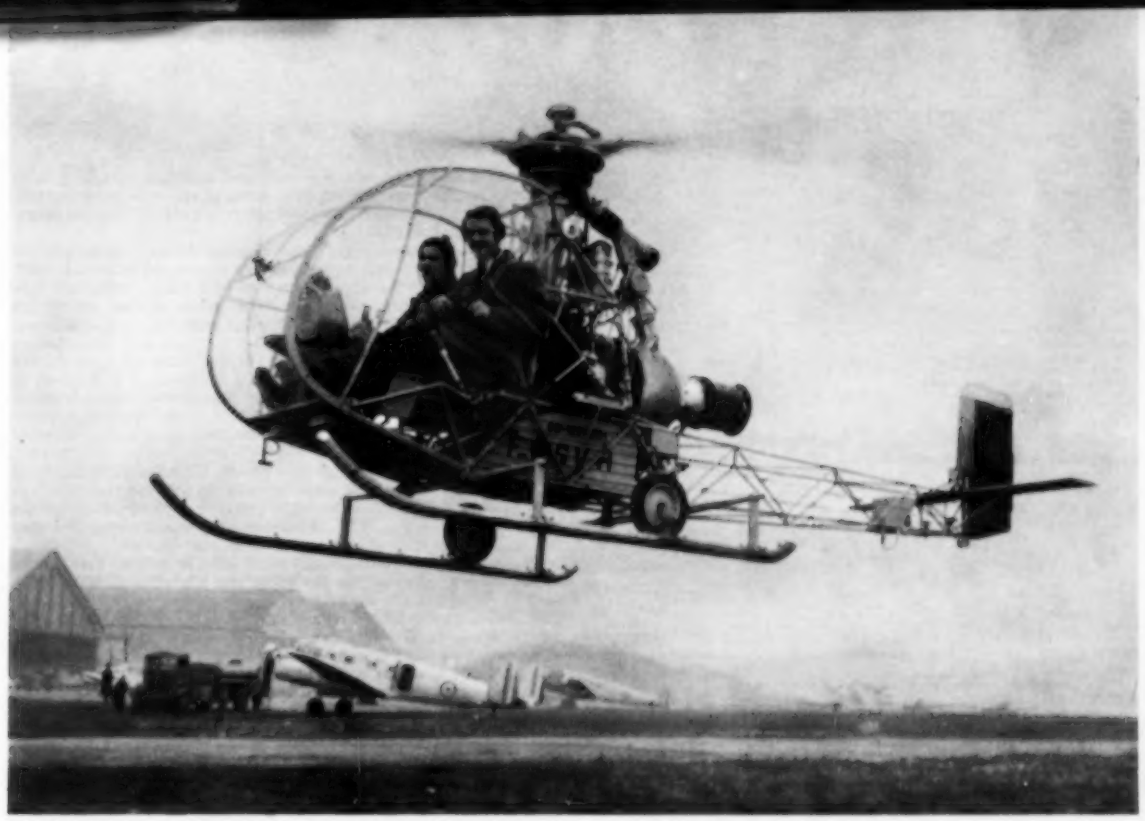


The S.O. 1221-001 Djinn returns from a jaunt round Villacoublay. The pilot is Jean Dabos (in woollen cap), with the author as passenger.

ACTUALITÉS FRANÇAISES

Part I: Djinn; S.N.C.A.S.E.; Fouga Magister; French Air Force Reserves

THE French nation as a whole is not very air-minded in its policies and opinions, but those Frenchmen who do use or build aircraft make up for their relatively small numbers by an enthusiasm, a skill and an inventive genius which the industries of few nations have been able to match. The attitude of the government to aircraft construction, particularly in regard to financial aid, is such that almost any good project can reach the prototype stage, and for the size of its industry France can surely boast a great number and a wider variety of basically new designs since the war than any other country. In the public eye these prototypes attract far more attention than the real work of production and operation that is going on, so to speak, in their shadow, and about which one hears much less.

I recently visited many of the companies in the French aircraft industry and in the space of a few days managed to see and hear a great deal of what was going forward. I saw prototypes and production aircraft, both in numbers, and the men responsible for them; and it does seem that now an ever-increasing amount of real production is in hand. Perhaps most impressive in terms of numbers are the Mystère lines, which are turning out these swept-wing fighters at a high rate from at least four factories. In addition there are the Noratlas (orders for which are likely to be increased for the third time), the Magisters, now getting well into their stride, the Vautours and the Djinns; and once again the Nord-alphas and Norécrins are to be produced, with 100 Morane 760 Paris to follow as replacements.

Among the Djinns: My tour began on a Wednesday, a few weeks ago, and my first port of call was the S.N.C.A.S.O. hangar at Villacoublay main airfield where M. Bolo, head of the sales department, let me loose among the eight 1221 Djinns which have so far been built. These machines are part of a pre-series of ten which by the end of the year will be delivered to the French Army to fulfil the first part of an order for liaison and artillery purposes. In addition, tucked away at the back, there were the Djinn's predecessors the Ariel II and Ariel III, both dismantled. The Farfadet was also there, less its Artouste turboprop; work on the Ariels has now stopped, but the Farfadet has only temporarily been put aside while the Djinns are being finalized. I was told of a larger, four-seat version of the Djinn, now on the boards.

Also in the hangar was the small Deauville two-seat, all metal, low-wing monoplane with tailwheel undercarriage, which was a little something designed by way of relaxation some years ago. Next to it stood the diminutive first prototype 1220-01 Djinn—a single-seater.

Few of the eight 1221 Djinns are the same in all respects, some having intake silencers and others jet-pipes of cylindrical form with flow-straighteners to improve the directional control. One, particularly, was fitted for hand starting, the intention being that the pilot should be able to start the engine by himself and be independent of batteries when working away from his base. By pulling a small lever fuel pressure can be raised in a cylinder, and then the engine is hand cranked (by a direct drive on the accessory

A rotor-head view of the Djinn. The hand starting shaft can just be seen behind the Palouste's air bleed pipe.

". . . the lorry broke away into the rough ground"—a photograph of the incident related in this article. "Flight" photograph

The S.E. 2310-03 being loaded and prepared for the journey from Villacoublay-Morane to Toulouse. Note the wing fence, radio aerials and unfortunate door-opening arrangement. "Flight" photograph

ACTUALITÉS FRANÇAISES . . .

casing) up to 10,000 r.p.m., the igniter being activated at 3,000 r.p.m. The operation complete, the handle is clipped to the airframe and the pilot climbs in and flies away. The same starting handle fits into a socket and enables the taxying-wheel mountings to be rotated over top dead centre so that they extend below the skids. A 12in-long tuft of blue wool trailing at the tip of a small mast in front of the windscreen, originally a flight-test gadget, has proved so useful for general flying that it is to be retained on standard machines.

The Djinn has already been tested with two stretchers, but one machine is flying with two extra fins mounted on the fixed tailplane for tests with large external loads. Incidentally, the company hopes to deliver the Djinn with a rotor-blade life of 1,000 hours and the possibility of changing only one blade at a time.

In misty weather and about 1,000 yards' visibility the Djinn was the only machine flying at Villacoublay, and I was offered a ride in 1221-001 (registered F-WGVH) with Jean Dabos, the company's test pilot. He had just returned from his magnificent Alpine exploits, in which he had landed on the Mönch at 13,490ft. This was done to show that the Djinn was easily capable of fulfilling a Swiss Army requirement for a helicopter to land two people on the lower Jungfrau (11,243ft).

Dabos gave me a demonstration of the Djinn's manœuvrability, the machine cavorting round the field with a loud threshing and flapping noise. It leapt into the air, shot away in this direction and that, hovered, spun round on its own axis and then came obediently back to a gentle landing in front of us. I sidled up to the aircraft under the whirling rotor and attached myself to it by a four-point harness, feeling that most of me still hung outside the machine itself; unlike the other models, 1221-001 has no doors, and the wind was cold.

As Dabos hummed a gay tune into his throat-microphone we threshed our way gently to the caravan at the end of the runway. Close inspection from above, opposite and below, suggested that nobody was at home. Dabos therefore went seeking rabbits on the other side of the field, weaving this way and that, still humming, and trying to explain that, although there were none today, the rabbits were usually plentiful. He did, however, spot a lorry bowling along the perimeter track and approached it head-on at about 5ft, chuckling as he wondered who would lose his nerve first. When some 30yd separated us it was the lorry that broke away into the rough ground, and the helicopter pulled up over the top of it.

Dabos later demonstrated one of the Djinn's party tricks, a dead-stick take-off. He wound the rotor up to maximum speed at fully fine pitch, throttled the engine right back and pulled up the collective-pitch lever. The Djinn instantly sailed about 20ft into the air, then settled back to a landing in autorotation.

It is a remarkable little machine, and the first helicopter I have known which gives to the passenger the sensation of fixed-wing flying. There is no vibration and only a very slight "once per rev" beat. Noise level is too high for comfortable speech, but intake silencers for the Palouste Mk 4 are at present being attached. As a French army artillery spotter the Djinn will carry a pilot, and the observer who will wear a "walkie-talkie" type radio.

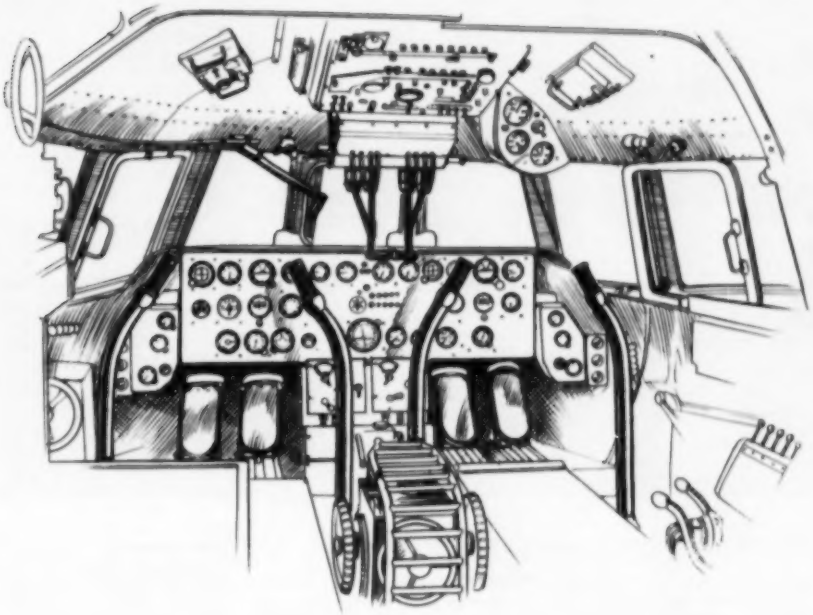
In the hangar next door to the Djinns I was next shown the two French Government V.I.P. aircraft, S.O.30P. Bretagne No. 24, *France*, for the President, and No. 25, *Anjou*, for the ministers. Except for sumptuous furnishing in the palest wood, these aircraft are standard Bretagnes, with Pratt and Whitney 2800 CA-18 engines (2,400 h.p. with water injection) and Hamilton Standard four-bladed square-tipped metal airscrews. Each aircraft carries accommodation for 12-13 people and cruises at 263 m.p.h. with a 1,560-mile range. *France* has three compartments, including an office, a bed-sitting-room and a bar, and *Anjou* has just two, with rather more seats. The aircraft are permanently housed at Villacoublay.

S.N.C.A.S.E. Today. After a quick lunch I went to the adjacent Villacoublay-Morane field (home of Hurel Dubois) where Jacques Noetinger, of the French equivalent of the S.B.A.C., was to collect S.N.C.A.S.E. test pilot Lecarme's S.E.2310-03 for our flight down to Toulouse-Blagnac to see the Caravelle. The S.E.2310-03, as its number indicates, is the third prototype (registered F-BEEL) of the design, built some years ago and not produced in quantity. It is an all-metal, four-seat, low-wing monoplane with a fixed tricycle undercarriage and a S.N.E.C.M.A.-Régnier 140 h.p. engine. It has been for some time Lecarme's own hack and still has a number of flight-test instruments in it, but it also carries a comprehensive radio installation, including a Plessey P.T.R.61 six-channel V.H.F., Lear LR-5E receiver (108-127 M/cs) for V.O.R. and I.L.S., an I.L.S. cross-pointer, Lear A.D.F.-12 Orienter, a radio-beacon receiver and a cathode-ray omni-indicator.

With three up, baggage and 44 gallons of fuel the 2310 is not a good starter, since the fixed-pitch airscrew is set for cruising. We anxiously burnt up some 400 to 500 yards of rough grass before staggering into the air and Jacques then had to hold the aircraft down to wait for the climbing speed of 93 m.p.h. to build up. Once airborne we discovered that the starboard door was held shut only by the stand-by latch, and even after some probing both inside and outside the aircraft we were unable to close it properly. But Jacques decided to continue as we were rather than land, fix it and have to attempt another take-off.

We cruised at 100 m.p.h. indicated at 2,100 r.p.m. and reached Toulouse through steadily improving weather after 3hr 10min,

Part of the fleet of seven S.E.2010 Armagnacs operated by the composite Société Auxiliaire de Gérance de Transports Aériens, who run a military passenger service from Toulouse to Saigon.



The Armagnac's cockpit has several distinctive features. The double control columns are pushed differentially up and down for aileron control and pulled or pushed for elevator. There are apparently no engine instruments on the main instrument panel and the throttles are on the ceiling. The lever across the captain's windscreen is the control lock in the "locked" position. The engineer sits in the right foreground and the radio operator to the left.

making full (but mostly unprofitable) use of the radio equipment; interference was very bad.

Just after we landed at Toulouse-Blagnac, already feeling the warmth of the southern sun, a Nord 2501 Noratlas accompanied by a photographic Marcel Dassault Flamant, dropped a 8,800-lb specimen load with the aid of two extremely large white parachutes. One of these opened explosively and tore away immediately, while the other, with its centre torn, candled behind the load without retarding it very much, leaving a sky full of floating debris, and crashing down about 400yd away from us. Such consequences are not at all uncommon in any operation of this kind. We taxied up to the S.E. hangar, where we were met by M. Douat, the engineer in charge of liaison between the S.N.C.A.S.E. design and construction departments for the Caravelle.

The Trusty Armagnac. We had dinner with M. Douat and heard how S.N.C.A.S.E. are overhauling French Air Force F-84Gs, turning out one Mystère IVA forward fuselage every 13 hours and jointly operating the fleet of seven S.E.2010 Armagnacs between Toulouse and Saigon. The company is proud of this service which, *via* the Middle East, Karachi and Calcutta, maintained four round-trip services per week with seven aircraft during the height of the fighting in Indo-China. The Armagnac has by all reports behaved with the utmost decorum and given the very minimum of trouble.

Though now ageing and probably on the verge of honourable retirement, the Armagnac is a most remarkable aircraft. Firstly it is very large, with a fuselage diameter of some 16ft, and pressurized. This girth can be appreciated from the fact that, though the airscrews look small, they are nevertheless of 14.7ft diameter. The engines are P. and W. Wasp Major R-4360s of 3,500 h.p. The passenger accommodation is for 84, seated six abreast, with full galley and toilet facilities. The all-up weight is 170,000lb and the range 3,190 miles. No one can deny that, for an aircraft of the late 1940s, these figures are impressive.

Nine Armagnacs were built in all, one being written off in an early test accident, another now serving as a test-bed for two Vulcains slung under the wing-roots and the others flying with the present joint S.E./Air France company called S.A.G.E.T.A.

The Armagnac has a particularly distinctive feature—an idea originated by M. Lecarme, the company's test pilot, and one which was also employed in the S.E. Grognard—namely, the arrangement of the pilot's control column as a double unit. There are two "sticks", one on each side of the pilot, and elevator control is achieved by pulling or pushing them both together, while the ailerons are moved by pressing them differentially up or down. With eyes shut this gives the same impression as rotating a conventional spectacle wheel, but with them open the effect is very different. For the record the Armagnac's cruising speed is 281 m.p.h. at 143,000lb weight.

Caravelle and Magisters. The next 36 hours I spent in a hectic but most interesting inspection of the Caravelle, the first prototype of which is nearing completion and may well have done the necessary ten hours' flying in time to allow it to be demonstrated at the Salon in June. The only things I could not see were the Avon RA.26 engines, which are subject over there to even more rigid security restrictions than in England.

The aircraft has all the appearance of a first-class engineering project, and *Flight* hopes in the near future to publish a full description of it.

We turned aside from the Caravelle only to have dinner with M. Grangette, the test pilot of the Fouga company, whose C.M.170R Magisters are being built at Toulouse-Blagnac. From him I heard that eight of these twin-jet trainers have been completed and seven already delivered to the French Air Force. Flight tests are continuing with a view to raising the Mach number, the highest so far reached being 0.836, with buffeting starting at 0.76. It seems probable that powered ailerons will soon be fitted.

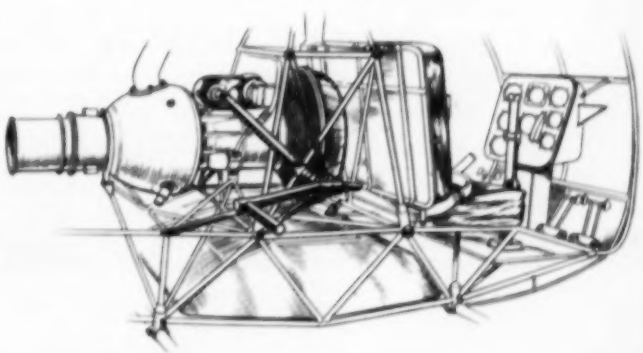
A discussion arose about instrument and equipment performance. It appears that the fashion which hitherto dictated the use of foreign-made instruments is slowly losing ground, and that a number of French companies are now producing first class equipment. Particular concerns mentioned were Besu, Bronzavia and S.F.E.M.A. The production Magister is equipped almost totally with French instrumentation.

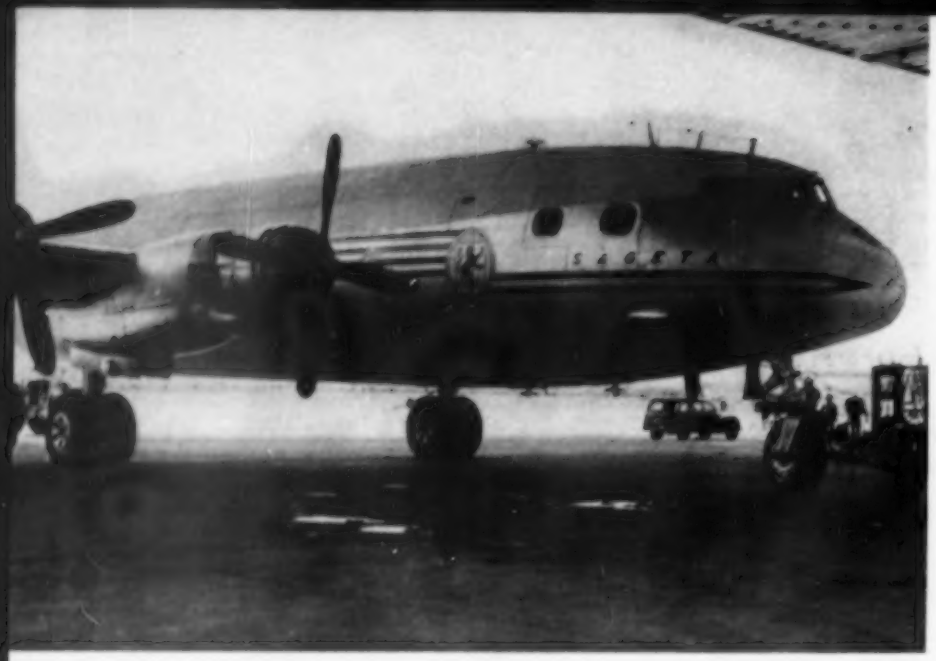
Immediately after lunch on Friday Jacques Noetinger and I set out once more for Paris in the S.E.2310-03, this time making sure that all doors were closed and secure. Against a head wind it took us 3hr 25min to reach Villacoublay-Morane, cruising at 100 m.p.h. indicated at 2,000m (6,600ft) and 2,100 r.p.m., and at 118 m.p.h. somewhat lower down below a cloud layer over the last part of the route.

In common with most aircraft of this configuration the S.E.2310 is a little noisy and draughty, but it has a formidable endurance of six hours with a cruising consumption of 7.9 gall/hr.

We landed at Villacoublay-Morane and I was able to take a

This simplified drawing of the S.O. 1221 Djinn engine installation shows the new engine-intake silencer and the jet-pipe of cylindrical form, whose internal vanes straighten the flow over the aerodynamic rudder at the tail. Prominent in the foreground is the hand starting drive with the detachable handle in place. The starter drive acts directly on the accessory gearbox.





The mighty S.E.2010 Armagnac, its 14.7ft airscrews dwarfed by its vast fuselage, is towed from the hangar at Toulouse-Blagnac. The single hangar door, counter-balanced, and raised by a 6 h.p. motor, was until recently the largest in Europe.

ACTUALITÉS FRANCAISES . . .

quick look into the new Hurel-Dubois hangar, now completed, where I saw the H.D.31, the Praga-engined H.D.10 and two H.D.32s. The H.D.32-01 now has two small extra fins on the tailplane and a small ventral fin extension, and the air brakes have been perforated. The H.D.32-02 is not so fitted. This latter, incidentally, is the aircraft of which we published a detailed cut-away drawing last year (*Flight* of June 18th, 1954). The H.D.32-01 originally appeared with the twin-fin tail and has since been modified to its present configuration. In another section of the factory I saw the mock-up of the fuselage, forward of the wing, of a photo-survey version of the H.D.32. The nose is completely redesigned with the two pilots' seats raised on platforms, one on each side of a central trough giving access to the transparent extreme nose section. Here there is one fixed seat for the camera operator with, in addition, a jump seat on the left-hand side. Two large camera ports have been cut in the floor of the forward part of the main cabin and an overhead gantry runs from these aft to a floor rack holding a number of large film magazines. A further gantry can be swung outboard from the forward loading door so that these magazines can be hoisted in and out of the aircraft. There are, altogether, five crew-stations, including two pilots.

Next morning I went with Jacques Noetinger to the new French Air Force base at Creil, north-east of Paris, where he and about 45 other pilots of the French Air Force Fighter Reserve (in which he is a captain) fly S.E.-built Vampire 5s. There are two squadrons, Nos. 1/17 and 2/17, and about 25 aircraft, not including some S.N.C.A.N. Martinet (originally Siebel Si204) instrument trainers. These squadrons—and another, with about 20 pilots, in North Africa—are the only French reserve units comparable with our own R.Aux.A.F. Their training is organized in almost exactly the same way as that of their English equivalent, and in an emergency the unit at Creil would form part of the fighter defence of the Paris area. The squadrons are commanded by Capt. Blanc, a Regular officer, and about 30 Regular pilots fly the Vampires when the Reserve pilots are away. I was also shown there an Air Trainers' AT.50 jet Link trainer. The Reserve pilots achieve an average of between 50 and 80 flying hours a year.

The station commander at Creil is Col. De Fouquière, who will very shortly have under his command one of the first Mystère II squadrons.

There is another type of French Reserve—organized on a regional basis in such towns as Paris, Lyon, Bordeaux, Aix-en-Provence, Nancy and Lille—in which pilots who already have their wings fly the French equivalent of the Harvard, the Morane Saulnier 475.

On the way out to Creil very early in the morning, Jacques Noetinger told me about the Postale de Nuit, the night mail service which is being run, using mainly Dakotas with Air France crews, as a joint venture by Air France and the Government. Mail flights are made every night between Paris and the major cities of France, so that a letter can be posted in the evening in Paris, for example, with the certainty of its being delivered next morning. The object is to maintain 100 per cent regularity and punctuality, completely regardless of weather conditions, and so far regularity has in fact been better than 99.9 per cent. There is something reminiscent of the early (but much less well-equipped) night air-mail services which were run in the 1920s both in France and America, and though the present regularity must owe much to comprehensive radio navigation equipment and landing aids, the human factor can be no less important now than it was then, and the crews have a high reputation.

C.M.L.

(To be continued)

J57 FOR SMITHSONIAN

THE original Pratt and Whitney J57 axial-flow turbojet is being presented to the Smithsonian Institution in Washington for permanent display. Designated X-176, it was released for experimental testing during June 1949. Of "barrel" shape, it was superseded by the present "wasp-waisted" configuration during August 1950, after it had run for 143 hours. Already in the Smithsonian are the original nine-cylinder radial Wasp (1925) and one of the Wasp Majors which powered the B-50 *Lucky Lady II* on the first non-stop flight round the world in February 1949.

ALUMINIUM CENTENARY

AIRCRAFT components will be prominent among the exhibits at the "Aluminium 1955 Exhibition" to be held at the Royal Festival Hall, London, from June 1st to 11th. The theme of the exhibition is the use of aluminium in many industrial fields and the progress made since the metal first came to this country just a hundred years ago. There will be five main sections, dealing respectively with the historical aspect, production, research, applications and the future. The "applications" exhibits will be divided into twelve sub-sections, covering the following fields: aircraft, marine, consumer goods, electrical engineering, road transport, railways, structural engineering, general engineering, packaging, chemical engineering, building, agriculture and food processing.

The aircraft exhibits are likely to include typical forgings and castings, up to large spar-boom size; illustrations of such modern techniques as honeycomb structures; and an early light-alloy airscrew contrasted with its modern counterpart.

The exhibition is being organized by the Aluminium Development Association on behalf of the aluminium industry, and the general design is by Mr. Ronald Dickens, M.B.E., F.S.I.A.

AUSTRALIA'S NEW ATOMIC RANGE

THE Ministry of Supply stated recently that agreement in principle had been reached between the Australian and United Kingdom Governments on the establishment of a proving ground for atomic weapons within a proclaimed prohibited area in the South Australian desert. Construction work on the site, which is known as Maralinga, will begin shortly.

The site previously used for atomic tests—situated within the Woomera Range and known as Emu Field—has been found unsuitable for further tests, owing mainly to shortage of water and the fact that supplies have to be flown in. Much of the Emu Field equipment, however, will be used at Maralinga.

The Ministry states that no hydrogen weapon tests, or trials of a comparable nature, will take place in Australia. The nature of tests at the new site will be the subject of prior agreement between the two Governments.

"Flight" photograph

The B-45A-NA-5—belonging to the 86th Squadron of the 47th Wing—the handling of which is described below.

AT THE CONTROLS OF THE B-45

Second-pilot Time on a Four-jet Bomber

By C. M. LAMBERT

WE make no apologies for describing here the flight characteristics of an aircraft which dates as far back as 1947 in design. For one thing, this is only the second time that permission has been officially granted for anyone to fly and describe an operational American jet bomber; for another, the B-45 is still, despite its age, a most interesting aircraft and the first of its type which we have been permitted to describe in England. Generous facilities, also, were granted by U.S.A.F. headquarters in Washington to take air-to-air photographs, and those published here and on March 25th were secured from a Lockheed T-33 put at our disposal by the 86th squadron of the 47th Bombardment Wing (Light), which also supplied the B-45.

Permission having been granted from Washington, we wended our way to Sculthorpe, the base of the 47th Wing. The light being just right for photography, it was decided to get airborne as soon as possible, and McLaren (with camera) and I were swiftly equipped and briefed for flight. Our clothes consisted of suits, Mae Wests, back-type parachutes and Lombard crash helmets with A13A pressure-demand oxygen masks. Of these and the related cockpit equipment, more later.

We were then introduced to our crews, Lt. I. L. Prado (86th Squadron) pilot of the T-33, and Maj. H. J. McGee and Maj. A. C. Wilhelm, respectively pilot and bombardier/navigator of the B-45. Maj. Wilhelm is a member of the 86th Squadron, but Maj. McGee was inspector of the Wing. He had, in fact, been detailed to fly me, since he was due for "rotation" to the U.S.A. and required only an hour and forty minutes' B-45 time to make up the round thousand on type. In terms of time served he was one of the two oldest members of the Wing, having been with it since its early war years in North Africa. We drove out to the aircraft, a B-45A-5, and I had a few moments in which to look it over from the outside.

The first face-to-face meeting with an aircraft one has not previously inspected at close quarters is always interesting. The impressions "in the flesh" are always refreshing, if only because of the number of new aspects one can appreciate while just walking up to it.

Crews of the B-45 and the photographic T-33 (left to right): Maj. H. J. McGee, pilot, and Maj. A. C. Wilhelm, navigator/bombardier; Lt. I. L. Prado, T-33 pilot.

The B-45 is a puzzling aircraft, and my impressions are all coloured by the feeling that it ought to be more difficult than it is. A number of its features I did not and do not like, though none so much as to change my overall opinion that this must be one of the most tractable and "ordinary" large aircraft built. And yet, on the face of it, it has no right to be so. The answer is that considerable internal complication of equipment has not been allowed to detract from simplicity of operation.

So many factors could militate against this simplicity—high all-up weight, comparatively high performance, four turbojets and complexity of systems and equipment. Yet the B-45 is delightful to fly, steady, light and responsive and completely straightforward. It can be driven on the ground almost like a car, and flown like a much lighter aircraft: it woffles over the hedge at only 130 m.p.h. and is quite happy on a 2,000-yd runway. As for its top-speed performance, it is not remarkable by modern standards. The top speed low down is marked on the A.S.I. as 550 m.p.h., and the maximum permissible Mach value as 0.76. The ceiling is "above 40,000," immediately after full-weight take-off.

Entry is *via* a door beside the bombardier's station on the port side, whence a deep corridor leads aft to the bomb-bay. As one crawls along this corridor, the floor of the cockpits proper is at shoulder level, and one reaches the seats by worming one's way up between the floor and the cockpit coaming. For the inexperienced, wearing the back-type parachute, this can be a two-man job. The left arms of the ejector seats are lowered to give more room and also to prevent the entrant from accidentally pulling the pre-ejection lever and prematurely arming the seat.

Once in "the office" there is ample room and, though one can see little enough forwards from the back seat, the view from the front is excellent. All-round view corresponds to that from a fighter, both forwards and backwards. The co-pilot in the rear has only such gear as will allow him to handle the aircraft in the air. He cannot see very much in front and for purely flying equipment he has, in addition to the control column and rudder pedals, only the six basic blind-flying instruments, four throttles, "press to transmit" button and elevator trim switch.

I would have the following criticisms to make at first sight of the seat and its equipment. It is not automatic and does not seem to fit so closely to the body as the R.A.F. type. The back-type parachute harness has three hook fastenings which are not too easy to undo and would be most difficult to get rid of in a hurry. The harness is completely quick-adjusting, but this brings with it the inevitable penalty of long lengths of strap hanging loose about one.

To fire the B-45's seat one first raises the pre-ejection lever on the end of the right arm-rest, thus exposing the firing trigger beneath it. Then the seat-arming lever, in the corresponding position on the left arm-rest, has to be pulled in order to make the seat "live". After that the hood is jettisoned from the front cockpit or by one of two large manual jettison controls (one at each pilot's position) and the pilots are free to go. Once clear of the aircraft they release themselves from the seat manually and either use the direct rip-cord on the left side of the harness or pull a red transparent knob below it to arm the barostatic device. This then causes the parachute to develop at about 10,000ft. An emergency oxygen supply is stowed in the pack and connected normally to the main oxygen lead on the mask. The seat-harness itself is of the standard American pattern with the two shoulder-straps terminating in leather loops which are threaded over the main clasp of the lap strap. The clasp itself

This view of the aircraft gives some idea of the proportions of the bomb-bay and engine nacelles. (Right) Seen here from about the pilot's eye-level, the front cockpit is well arranged. Panels are sloped in various planes to avoid parallax error when reading instruments. As this is a composite of two photographs, two instruments, the radio compass and A.S.I., appear duplicated.

"Flight" photographs

AT THE CONTROLS OF THE B-45 . . .

is a hook with a spring-plunger retainer device.

The shoulder-straps can be locked and tightened, or left to unravel at will on a spring-loaded drum. An inertia-sensing device locks them in their position at the moment of the application of a given forward acceleration. It is normal to leave them on the spring, because it is necessary to lean far forward out of the seat to reach many of the numerous banks of switches, particularly in the rear cockpit.

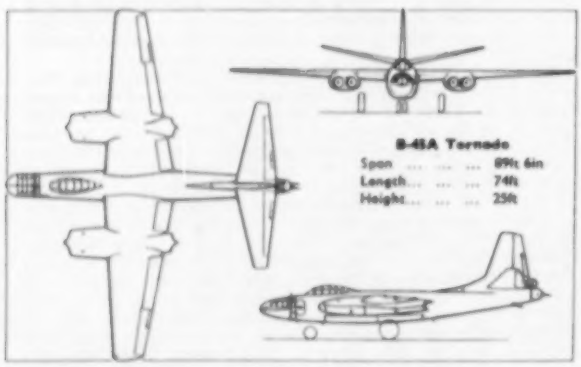
The control column (with "spectacle" wheel) can be disconnected from the controls and locked fully forward by pressing a trip-lever on the column. In the rear cockpit the rudder pedals can then also be folded up against the stick. This is an excellent feature for ease of access; when they are retracted there is plenty of room for movement, and retraction is a vital action before ejection. The front pilot's seat is quite high and the visibility over the nose excellent. From the rear seat it is not possible to see very much forward, because of the lowness of the seat and because there is a large "island" of equipment perched directly in the line of vision. In fact, the co-pilot can see the captain only when the latter leans down and sideways from his seat.

The aircraft is intended to be flown mainly from the front seat and for flying instruments the co-pilot has only, as mentioned above, a standard six-instrument blind-flying panel ("scattered" after the American manner), which is mounted low down and to starboard under the cockpit coaming. He has, however, a host of other switches and gadgets to look after.

Most of the instruments, including gauges for the eleven different fuel tanks, engine instruments, Mach meter, etc., exist only in the front cockpit, where they are very well arranged, notwithstanding their large number. Most of the dials not directly concerned with flight control are of the miniature type, about 1.5in in diameter. All are black with yellow lettering, sometimes relieved by splashes of green.

Despite the instrumental austerity of the rear cockpit, I found it pleasant and was able to enjoy an excellent view sideways, upwards and backwards.

The bombardier, referred to as the "A.O.B." has a well-lit den forward with the mysterious instruments of his trade laid out like the controls of some calculating Wurlitzer organ. Under the glazed upper portion of the nose there is only the quilted top of the radar



aerial compartment. About all this I was told nothing, and leave it to the reader to imagine. From what was said I gather that the A.O.B. cannot see much outside, but is sufficiently conscious of turbulence and bumps to know when another aircraft passes as close by as the photographic T-33 was shortly to do.

When I had got settled comfortably and watched and listened to the chanting of the long check-lists, the engines were started one by one from an external battery, each with a burst of characteristic J47 metallic snarling. The starting order was, as far as I could judge (having no rev. counters to watch) starboard to port. As soon as engines were all running we began to taxi out, making radio contact, and reading more lists of checks.

I was at once impressed by the almost complete quietness of the aircraft. Even at full power on the ground, just before take-off, the engines never made themselves heard as more than the faintest rumble, and there was no vibration at all. The roll along the ground was smooth and required almost no braking. At take-off we had 4.5 hours' fuel (the full internal load), and left the ground at 140 m.p.h. after 30 sec and a run of about 1,500 yd. We climbed at 300 m.p.h., at 80 per cent power and 2,000 ft/min.

Until the photographic part of the flight was over I simply sat and revelled in the smooth, effortless progress of the aircraft. I enjoyed the rays of strong winter sunshine and was kept warm by what appeared to be a well directed and efficient heating system. There was no need to don the somewhat voluminous A13A mask as the pressurization (6.2 lb differential) kept cabin altitude well below oxygen level all the time.

Lt. Prado, flying McLaren in the T-33, soon closed with us; and at 13,000ft, with the coastline of the Wash and bank after bank of snow-laden cloud for background, we began the photographic runs. The B-45 bored steadily on at 330 m.p.h. indicated as the smaller aircraft hovered silently now this side and that, the occasional remark being passed on U.H.F./R.T. Then the T-33 prepared for the "peel-off" over the top of the B-45, by which manœuvre overhead pictures could be taken. It poised itself, however, at pilot's eye-level and, applying some 45 deg bank came sweeping rapidly in with its tip tank aiming at our cockpit. When collision seemed inevitable, Maj. McGee pushed our nose gently down and the T-33 flashed by, its tip-tank hidden from my view in front of the windscreen and giving us a distinct bump of slipstream as it went. Subsequent passes went better, and by the time (somewhere over Nottingham) the T-33 left for home, I was feeling better again and ready to try the controls for myself.

I had had no idea what to expect and was most agreeably surprised to feel the lightness of the ailerons. The elevators are very much heavier—expressly so, to prevent the application of large amounts of g. Any out-of-balance stick forces on the elevator can easily be released by using the trim button on the control column with the thumb and forefinger of the left hand. I found it a little difficult to get used to this control, since the response was slightly delayed and I therefore tended to over-trim; one should simply "blip" the button. Lateral stability is effectively neutral, once one has checked the initial rate of roll with a touch of opposite aileron.

The controls are all boosted (power-assisted), with pressure so regulated—by a device which senses and balances the control surface load and the stick force applied by the pilot—that forces remain substantially constant at all speeds. There is therefore no "feel" of speed and reference must be made to the A.S.I. When, subsequently, I touched the "Mach" momentarily, the only indica-

tion was a light, continuous, burbling buffet. There was no indicatory sensation on the controls, since by then the boost must have been close to its maximum 3,000-lb level, and the surface-load feedback very small.

Making ordinary turns up to a bank angle of about 30 deg was absolutely normal and pleasant at 350 m.p.h. A.S.I. at 13,000ft. As bank was applied the nose tended to drop, but could be picked up by a "blip" of trim, and the opposite occurred slightly more pronouncedly when straightening up again. Most elevator movements are best made by combining trim and stick force. The captain has at his right side a lever by which he can electrically apply trim to all axes, in addition to the "stick-top" trimmer. The B-45 carries a Sperry auto-pilot with a joy-stick controller for both pilots and bombardier. For the pilots, the control is tucked away on the left and can be pulled out on an arm when required.

When I had sampled the controls, McGee took over once again and headed for base with the intention of carrying out a farewell beat-up. Under radar control from the ground, since the T-33 was also engaged in a fast gambol, we roared down on Sculthorpe and tore across the field at about 100ft and with the speed right on the maximum permissible mark—at 550 m.p.h. Pulling gently up, we zoomed effortlessly to 9,000ft and pulled out over the vertical at about 250 m.p.h. It was in cases such as this that one appreciated the quietness of the aircraft: "effortless" is the only word to describe that zoom, despite the fact that the engines were at 100 per cent. McGee, however, remarked that she would go faster than that, and made another pass. But, bumping and jolting in the rough air, we did not succeed, even in the dive, in exceeding 550 m.p.h. We began the dive for the second pass at 460 m.p.h. I.A.S. at 7,000ft. The V.S.I. registered 5,500ft/min (its highest reading is 6,000ft/min) and by the time we passed through the cloud layer we were up to 500 m.p.h. at 2,500ft. The A.S.I., indicating in m.p.h., has an extra red needle which at all times shows the maximum permissible airspeed corresponding to the design limit at low altitude and the maximum Mach value at height.

We now came in for a circuit and landing at 1,300ft, 40 per cent power and 320 m.p.h. There are no speed brakes at all and the slowing-down process from medium speeds can be slow; but when the throttles are pulled back firmly at high speed the deceleration is similar to that caused by speed-brakes. By the time we had lined up for the break and landing we were making 300 m.p.h. and in the initial turn the speed fell off to 200 m.p.h. The undercarriage was put down at this speed with 40 deg of bank. McGee "dragged finals" at 160 m.p.h., crossed the hedge at 150 m.p.h. and touched down on the main wheels at 130 m.p.h. The landing run was about the same as for take-off. We had been airborne for 50 min.

McGee taxied round for another take-off and on the way handed the steering over to me. To select nosewheel control a button is depressed on the first pilot's control column, and while he kept this pressed I could steer from the back by turning the aileron wheel. The field of vision was just sufficient. Steering itself required anticipation, because response was delayed; but once one was accustomed to this it was, as mentioned before, almost like driving a large car.

I was now treated to a demonstration only achieved occasionally and by skilled pilots. Major McGee lined up for take-off, went to 100 per cent power against the brakes, and made a normal short take-off (15 sec. to 100 m.p.h., 20 sec to lift off at 130 m.p.h.). The rate of climb was 2,000ft/min and 1,100ft was reached at 150 m.p.h. over the end of the 3,000yd runway. We then banked sharply to port and were back over the starting point, "on the deck," at 350 m.p.h. only 90 sec after releasing the brakes.

At this point control was once more handed over to me and I began a normal climb to height. On instructions I started at 460 m.p.h. and reduced at the rate of 6 m.p.h. per 1,000ft. Initial rate of climb was 6,000ft/min. At 25,000ft the speed is equivalent to 0.71 Mach. We were flying out-bound from base and at the top of the climb I made the 180 deg turn for the return leg. By this time I had found the sun troublesome and was flying on instruments, finding it easy enough until I began to turn. Here, however, I found myself following a slightly phugoid path and was told that this was due to the artificial horizon, which precesses throughout the turn. It takes a little while to get used to this, as one has to interpret its indications in relation to progress of the turn.

The compass also was confusing at first sight. It was the repeater of a gyro-stabilized magnetic compass, so arranged that the needle at all times showed the heading on an instrument face marked normally in degrees. This face, however, could be rotated so that the needle, or a desired heading, could be brought into the 12 o'clock position. This is, of course, quite the opposite of the R.A.F. Sperry G4F indicator, where the aircraft's heading is always at the 12 o'clock position and a free needle is rotated to mark a desired heading. The turn-and-slip indicator (of the ball and needle type now being standardized in the R.A.F.) had only one mark each side of the centre-line, labelled "four-minute turn"—rather lower than the R.A.F. standard Rate 1 two-minute turn.

I made the let-down as prescribed, by chasing the "maximum permissible speed" needle with the A.S.I. needle, keeping always about 30 m.p.h. in hand. The throttles were fully closed. This gives a very reasonable rate of descent, consistently in excess of 4,000ft/min. At 6,000ft this let-down is exchanged for a steady rate of 3,000ft/min, still with the throttles closed. As the speed drops off, the nose becomes progressively heavier and regular blips of trim are required.

McGee took over once more for the final run-in to base, guided the while by the A.O.B., who was watching base on his radar screen. He had actually identified it from some 80 miles out. The break and landing were much the same as before, with the wheels coming down in a 45 deg-banked turn at 200 m.p.h. We crossed the hedge after a short straight-in approach at 140 m.p.h. to touch down at 115 m.p.h., our weight now having gone down considerably after 1 hr 40 min of flying. The ground-run was about 1,500 yd down to taxying speed without extensive use of brakes.

This was the end of a most enjoyable trip, and I was only sorry that the visibility from the back seat was not good enough for me to try a take-off and landing myself. Maj. McGee, meanwhile, had completed his 1,000 hours on B-45s precisely and in fine style. It was a trip I could not wish to better, and while he decided to have a quiet word with the T-33's pilot about that first peel-off, I headed for one of the most gratefully downed whiskies of my life.

North American B-45A Tornado (Four General Electric J47 turbojets, 5,200 lb thrust each).—Span, 89ft 6in; length, 74ft; height, 25ft; all-up weight (less external fuel tanks), 85,000 lb; fuel capacity, 4,500 U.S. gal; max. sea-level speed, 550 m.p.h.; max. speed, 0.76 Mach; ceiling, 40,000ft plus. Extra fuel tanks can be carried in the bomb bay and in two 500-gal external tanks under the engine nacelles. No further details published.

A study in light and shade as the B-45 poses sedately for "Flight's" photographer.

Gleaming in the warm South African sunshine, the Britannia is seen on take-off at Johannesburg. The ten wheels are already beginning to retract.

BRITANNIA'S JOHANNESBURG TRIALS

Phase One of the Tropical Tests: Encouraging Preliminary Report

TROPICAL trials of the first production Britannia were rounded off in fine style on April 14th, when G-ANBA returned non-stop from Khartoum to Filton. Despite a headwind component of nearly 60 m.p.h., the aircraft covered the 3,150 miles in 10 hr 55 min at an average speed of 290 m.p.h.

Considerable satisfaction with both phases of the trials—high-altitude tests at Johannesburg and high-temperature trials at Khartoum—has been expressed by the Bristol Aeroplane Co. Full analysis of all the performance measurements made in Africa will take some weeks to complete. The company has, however, issued a preliminary statement on the Johannesburg trials which gives a good idea both of the nature of the tests and of the Britannia's response.

From the trials viewpoint, the Bristol report notes, weather conditions were excellent: winds were very light and temperatures were comfortably on the high side, averaging ISAC + 18 deg C (73 deg F). "Each morning," it continues, "a briefing meeting was held at 9.30 and at this it was decided exactly what was to be done. The aircraft generally took-off at about 11.30, and due to the finely accurate flying of W/C. Gibb the programme was executed efficiently, with despatch and without the necessity for second and third attempts."

The daily pattern of trials at Jan Smuts, which is 5,500ft above sea level, was substantially constant, the only changing factor being the progressive increase in the aircraft's weight. The programme was as tabulated at the foot of this page.

Bristol's statement explains that the power-cut points for the three-engine take-off and accelerate/stop cases differed in that for the former the starboard outer engine was cut (by HP fuel cock) at low speed, i.e., *circa* 125 m.p.h., whereas for the start/stops the aircraft was accelerated to high speed, *circa* 155 m.p.h., before the engine was cut. It also observes that after an accelerate/stop—which is the full simulation of an emergency condition—it would be permissible to renew the brakes, and continues: "It says much, therefore, for the Dunlop brakes, wheels, tyres and Maxaret anti-skid system that five accelerate/stops (one at 147,400 lb and with only partial reverse thrust from the propellers, and one at 150,000 lb), plus a set of six landing tests, plus 13 high-weight (130,000-149,000 lb) landings, plus all the other normal landings were made before it was thought necessary to change the brakes. An advantage of the Maxaret system is that it ensures even tyre wear all round the circumference; the wear of individual tyres may vary among themselves, but the wear on any one tyre is even."

As an instance of typical landing performance, the following is cited: with the aircraft at 116,000 lb (i.e., 1,100 lb over the normal maximum landing weight) the measured distance from clearing 50ft to standstill was 3,400ft. The Britannia was, in fact, on one occasion landed at 149,000 lb—34,000 lb over the normal maximum. Bristols agree that "Perfect weather conditions and knowledgeable handling contributed much to this," but add that "even so it also says a good deal not only for the British Messier undercarriage, but for the quality of the structure as a whole."

Another set of figures is quoted as an indication of the standard of the aircraft's performance: "In an accelerate/stop trial at the 150,000 lb maximum all-up weight of the Mk 100, with an ambient temperature of ISAC + 18 deg C (73 deg F) and at a power-cut speed of 155 m.p.h., the measured start-to-stop distance was but 7,530ft. The quality of the results obtained throughout the accelerate/stop trials was somewhat better than had been expected and this is almost certainly ascribable to the fact that the de Havilland reversing airscrews proved to be more effective than had been previously realized."

Local interest in G-ANBA at Jan Smuts Airport, Johannesburg, where the Britannia's unusual low external noise-level caused it to be dubbed "the whispering giant."

Johannesburg Trials Programme

March 14th.—Four full-power take-offs at 112,000-124,000 lb; three three-engine take-offs at 114,000-123,000 lb; one accelerate/stop at 110,000 lb; four landings at 110,000-120,000 lb.

March 17th.—Three full-power take-offs at 132,000-140,000 lb; three three-engine take-offs at 132,000-137,500 lb; two accelerate/stops at 138,000 and 141,000 lb.

March 18th.—Two full-power take-offs at 144,000-146,000 lb; one three-engine take-off at 145,000 lb; one accelerate/stop at 147,400 lb (with only partial reverse-thrust braking).

March 20th.—Two full-power take-offs at 149,000-150,000 lb; two three-engine take-offs at 150,000 lb; one accelerate/stop at 150,000 lb.

March 22nd.—Two full-power low-speed take-offs at 135,000-137,000 lb; one accelerate/stop (superfine pitch), 137,000 lb; four landings at 114,000-120,000 lb.

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In the snow at Brooklands, early in 1917, is seen the first Camel of all, an F.1, with 110 h.p. Clerget rotary engine.

SOPWITH CAMEL PART I

HISTORIC MILITARY AIRCRAFT No. 10

By J. M. BRUCE, M.A.

ON December 22nd, 1916, the Sopwith Aviation Company's experimental department passed out a stocky little single-seat fighter which was to have a great influence on the course of the war in the air.

The Sopwith Biplane F.1, soon to be known as the Camel, was developed from the Sopwith Pup, to which it bore a family resemblance. In flying characteristics the two aircraft were not so completely dissimilar as most accounts imply; but because the Camel was heavier, more powerful and faster, its characteristics, good and bad, were more strongly pronounced. Things happened more quickly on the Camel, and the torque effect of its bigger and heavier engine was very marked, especially when changing direction. Both aircraft were manœuvrable, but whereas the Pup was docile, obedient, tractable, the Camel appeared waspish, wilful, intolerant.

Yet in the right hands the Camel was a lethal weapon. Its sensitivity to the controls made it the supreme dog-fighting aeroplane in the armoury of the Allies; only the Fokker Dr.1 could match its manœuvrability. The total number of enemy aircraft shot down by Camels was 1,294, a greater number than were defeated by any other single type of aeroplane of the 1914-18 war.

The Camel was a snub-nosed, hump-backed little biplane with staggered single-bay wings. The lower wing had a pronounced dihedral angle which contrasted markedly with the flat upper wing and seemed to accentuate the hump which enclosed the breeches of the two Vickers machine-guns. It was, of course, to that hump that the Camel owed its name. The name was unofficial, but so popular that it was ultimately accepted.

Structurally there was nothing unusual about the Camel. The fuselage was a wire-braced wooden box-girder with a rounded top-decking. Aluminium panels covered the first bay behind the engine; the sides were then covered with plywood as far aft as the rear of the cockpit; and the remainder of the structure was fabric-covered.

THE author wishes gratefully to acknowledge the assistance he has received from G/C. E. F. Haylock, with notes on handling qualities and the two-seat Camel, and from Mr. H. H. Russell, who provided much of the information about the Camels used by the various squadrons. Part II of this article will deal mainly with the 2F.1 Camel in Naval service and will include data on both the F.1 and 2F.1.

A standard Clerget-powered Camel of the R.F.C. The guns have been removed but one port is visible in the "hump" forward of the cockpit.

One of the factors which contributed to the Camel's manœuvrability was the concentration of all the greater masses within a short length of fuselage. The engine, guns, pilot and fuel were all close together in an overall length of about seven feet.

The wings were conventional wire-braced, fabric-covered wooden structures. On the prototype Camel the upper wing was in one piece, but on production machines it was made in three parts: a centre section and two outer panels. Naturally this led to a different disposition of wing ribs in the production Camels. The spars were of spruce; the lower mainplane rear spar was solid and the others were spindled-out for lightness.

The centre section was unusually wide and extended some way outboard of the centre-section struts. These struts were splayed outwards when seen in end elevation and were made of spruce, as also were the interplane struts. Ailerons were fitted to both upper and lower mainplanes.

The prototype Camel was powered by the 110 h.p. Clerget rotary engine, but production machines had the more powerful 130 h.p. engine of the same make. The F.1 Camel was also built in some numbers with the 110 h.p. Le Rhône.

The pilot sat between the rear centre-section struts, where a considerable portion of his field of vision was obscured by the upper wing. There was the usual cut-out in the trailing edge of the centre section, and a central aperture was made between the spars in order to improve the upward view. This opening varied in width according to the tastes of individual pilots, and was longitudinally bisected by the central compression strut of the centre section. The ailerons of production Camels were of slightly greater span than those of the prototype.

As a British fighting aeroplane the Camel's greatest significance lay in its armament. It was the first British fighter to mount the classic weapon installation—a side-by-side pair of synchronized Vickers guns firing through the airscrew. It was not by any means the first two-gun fighter, for several earlier enemy types had had twin synchronized guns; nor was it even the first British fighter to have two guns, for it was preceded in the Service by the S.E.5 with its combination of a Lewis and a Vickers. The Camel's fire-

SOPWITH CAMEL . . .

power was, however, greater than that of the S.E.5, because the belt-fed Vickers gun had a higher rate of fire than the magazine-fed Lewis. Moreover, the Vickers gun did not suffer from the disadvantage of requiring a magazine change every 97 rounds.

The Camel was ordered in large numbers from several contractors, and deliveries began in the early summer of 1917. By the end of June, 135 Camels had been delivered to both the R.F.C. and the R.N.A.S. By the end of July 1917, No. 70 Squadron R.F.C. and No. 6 Squadron R.N.A.S. were completely equipped with the type, and R.N.A.S. Squadrons Nos. 8 and 9 had begun to exchange their beloved Sopwith Triplanes for F.1 Camels. In the case of No. 9 (Naval) Squadron, re-equipment began on July 13th, 1917, and by August 4th the unit was an all-Camel squadron.

All of these squadrons, R.N.A.S. units included, had F.1 Camels with the 130 h.p. Clerget engine. So did No. 45 Sqn., the second R.F.C. unit to receive the type: its first Camel was delivered on July 25th, 1917, and the squadron was fully equipped with Camels by September 1st. No. 43 Sqn., R.F.C., was fully equipped with Clerget Camels by October 3rd, 1917. Five days later, No. 28 Sqn. arrived in France equipped throughout with the type, and other Camel squadrons were soon in action.

The first Camels to see action were those used by the R.N.A.S. at Dunkirk. As early as July 4th, 1917, five Camels from that station attacked 16 Gothas on their return journey from bombing Harwich.

On the Western Front the Camel arrived in time to participate in the Battle of Ypres which began on July 31st, 1917. The squadrons equipped with the type performed a variety of duties, chief among which was the mounting of offensive patrols; but occasionally ground-strafing attacks were made, and on October 20th the Camels of R.F.C. Squadrons Nos. 28 and 70 carried out a bombing attack on the enemy aerodrome at Rumbeke. Only twenty-two 25-lb bombs were dropped, but much damage was done and the enemy lost at least five aircraft.

Some seven weeks earlier two pilots of No. 70 Sqn. had flown their Camels at night on September 3rd in an unsuccessful attempt to attack German aircraft which bombed St. Omer. By a remarkable coincidence, three pilots of No. 44 Sqn.—Maj. G. W. Murlis-Green (20 E.A.), Capt. C. J. Q. Brand (6 E.A.), and Lt. C. C. Banks (10 E.A.)—also flew their Camels that same night in the hope of intercepting the Gothas which were attacking south-east England. These flights proved that the Camel, tricky as it was, could be flown at night.

During the Battle of Cambrai more ground-attack work was carried out by the Camel units, work in which R.F.C. Squadrons Nos. 3 and 46 played a prominent part. Casualties were heavy: losses averaged 30 per cent. The enemy batteries at Flesquieres, in Lateau and Vaucelles Woods, troops and gun emplacements in Bourlon Wood and Fontaine-Notre Dame—all were the targets of the low-flying Camels and D.H.5s.

Early in February 1918 the establishment of fighter squadrons was increased from eighteen to twenty-four aircraft. Clerget Camels were available, and it was decided to bring six Camel squadrons up to the new strength at once. Shortage of trained pilots delayed the realization of this plan for a short time, but by March 21st, 1918, seven Camel squadrons had an establishment of twenty-four machines plus one for the squadron commander. On that day the last great German offensive of the war opened.

The Camel squadron of the V Brigade, No. 54, was required to protect the aeroplanes of the Corps squadrons; once again Nos. 3 and 46 Sqns. were detailed for ground-attack work, and their targets were carefully decided and allotted. Early fog hampered aerial activity during the morning of March 21st, but the Camels of No. 46 attacked enemy batteries north of Bourlon Wood as early as 6 a.m.

Gallant and hazardous as those ground-attack missions were, they were unspectacular in comparison with the dog-fighting in which the Camel excelled. The aircraft owed its success to its phenomenal manœuvrability. The elevator was extremely powerful and the ailerons sensitive, but it was the Camel's startlingly quick reaction to coarse handling that was the undoing of so many of the pilots who attempted to fly it. At full throttle it was markedly tail-heavy, and the absence of an adjustable tailplane made it tiring to fly. It could turn in an unusually small radius, thanks to its short fuselage and the concentration of weights, but torque effect endowed its right-hand turn with characteristics different from those manifested when turning to the left. In the right-hand turn the Camel tended to drop its nose; conversely, the nose tended to rise in a left-hand turn. These tendencies had to be corrected by means of the rudder, of which a good deal was necessary, so it is hardly surprising that, if any turn were tightened too much, the Camel would quickly spin out of it.

But once a Camel pilot had become accustomed to his sensitive mount and understood its idiosyncrasies he found it to be an ideal fighting aeroplane. In combat, what the Camel lacked in speed it made up for in quickness and ease of manœuvre. Thus one comes to read of actions such as that fought on March 22nd, 1918, when twelve Camels of No. 73 Sqn. and twelve of No. 80 Sqn. shot down six enemy aircraft in the course of a patrol which included three different combats, two of them against superior numbers.

Two days later, Capt. J. L. Trollope (18 E.A.) of No. 43 Sqn. created a record by shooting down six enemy aircraft in one day. He brought down two D.F.W. two-seaters and an Albatros scout in the morning, and his afternoon bag consisted of three enemy two-seaters. On April 12th, 1918, Capt. H. W. Woollett (35 E.A.), also of No. 43 Sqn., duplicated Trollope's achievement. He shot down three enemy machines during the morning; and in the afternoon a Pfalz, a two-seater and a Fokker fell to the guns of his Camel.

Nine days later, on April 21st, the Camels of No. 209 Sqn. fought an action which, although little different in its nature from many another of that period, was an historic combat. One of the three Flights which had left Bertangles at about 9.30 a.m. broke away to attack two Albatros two-seaters, one of which was shot down in flames by Lt. M. S. Taylor; the other disappeared. The two remaining Flights were led northwards towards the Somme by a Canadian pilot, Capt. A. R. Brown (13 E.A.). Two of the ten Camels had to return to Bertangles with minor defects. Just after 10.45 a.m. Brown saw anti-aircraft shells bursting over Hamel.

He immediately led his formation in that direction and found two Fokker Dr.Is attacking two R.E.8s of No. 3 (Australian Flying Corps) Squadron. But on the fringe of the fight were fifteen Fokker Dr.Is and Albatros D.Vs which turned to engage the Camels. Although outnumbered by two to one, No. 209's Camels fought doggedly and not without success, for Lt. F. J. W. Mellersh (9 E.A.) and Lt. W. J. MacKenzie each drove down one of the enemy.

One of the embattled Camels was flown by 2nd Lt. W. R. May, who had newly joined No. 209 Sqn. and was a novice in air fighting. His orders were to avoid combat and make for home in the event of his Flight being involved in a fight. After a brush with a Fokker, May found himself clear of the main fight. He turned west for Bertangles, but almost immediately became aware of an all-red Fokker Dr.I diving towards him.

But the Fokker had been seen by Capt. Brown, who at once dived to May's assistance. The red triplane clung closely to May's twisting, turning Camel, and the German pilot's whole attention was obviously on his quarry. A certain Leutnant Kurt Wolff was, for once, not near at hand. Brown found himself above and to the right of the red triplane. One burst from his guns sufficed to shoot down the Fokker, which struck the ground not far from Corbie. The pilot was found to be dead.

Thus died Baron Manfred von Richthofen, Knight of the

Clerget Camel with auxiliary mid-bay flying wires.

Camel with 100 h.p. Gnome Monosoupape engine.

Dual-control Camel.

Camel with tapered wings. (Below) Camel with downward-firing Lewis guns.

Ordre pour le Mérite and victor in 80 aerial combats.

Brown did not know the identity of his victim until some time after the combat. He immediately turned back to engage two more Fokkers, which retreated under fire, and he landed at Bertangles with a damaged engine and fifty bullet holes in his Camel.

At that time No. 209, in common with the other ex-R.N.A.S. Camel Squadrons, was equipped with F.1 Camels powered by the 150 h.p. Bentley B.R.1 engine. One of the hardier fables relating to aeroplanes of the 1914-18 war is to the effect that the B.R.1 was fitted only to the Sopwith 2F.1, but that engine was in fact installed in large numbers of the F.1 Camels used by R.N.A.S. Squadrons. (Another cognate myth is that R.N.A.S. units used only the 2F.1 version of the Camel.)

An F.1 powered by a 150 h.p. A.R.1 (or Admiralty Rotary, as the engine was originally named) was tested as early as May 1917. Tests with a B.R.1 were carried out in July 1917. During the course of these trials the compression ratio was varied and larger induction pipes were fitted. Ultimately the best performance was achieved with large induction pipes and a compression ratio of 5.7 to 1.

No. 9 (Naval) Sqn., later No. 209 Squadron, R.A.F., was typical of the units which flew F.1 Camels with B.R.1 engines. Its original Camels were standard Clerget-powered machines, which it flew until December 16th, 1917. The squadron then flew B.R.1 Camels until February 4th, 1918, when it reverted to Clergets for some six weeks. On March 13th, however, Naval Nine again had B.R.1s and retained them until January 21st, 1919.

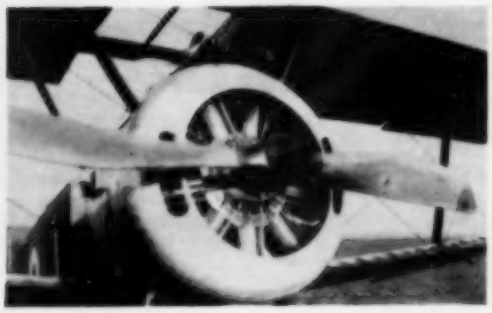
The Camels of the Naval squadrons were much more gaily decorated than those of the R.F.C. units. The pilots of No. 209 had various personal markings on their machines; few of the Camels had roundels on the fuselage sides. Those of No. 210 Sqn. were painted with longitudinal stripes which ran from the cowling to the back of the cockpit: "A" Flight had black and white stripes, "B" Flight blue and white stripes, and "C" Flight red and white stripes.

During the final great Allied offensive in 1918 the Camels of No. 209 were extensively used for ground-attack work. To provide adequate cooling for the engine, additional slots were cut in the cowlings of many of the aircraft. Squadrons Nos. 43, 54, 73, 201, 203 and 208 were employed on these duties, and No. 73 was placed at the disposal of the Tank Corps Commander for low-flying attacks against anti-tank guns.

By this time American squadrons were in action on the Western Front. In June 1918 the American Government bought 143 F.1 Camels, which were issued to the 17th and 148th Squadrons of the United States Air Service. The 17th Sqn. arrived in France on June 20th, 1918, and the 148th on July 1st. Both units were attached to the R.A.F. until November 1st. The 17th suffered the loss of six of its Camels in a fight on the evening of August 26th, but the two American units scored a resounding success on September 24th: of the eighteen enemy aeroplanes shot down on the British front on that day, six fell to the 148th and five to the 17th.

For duty on the Western Front 36 Clerget Camels were supplied to the Belgian Flying Corps. The machines were used by several Belgian squadrons. The 1st Squadron of the Belgian Flying Corps tried a few Camels but preferred their Hanriot HD-1s; their Camels were transferred to the 11th Squadron.

The Camel's operational service was not limited to the Western Front, for it was used in Italy, Macedonia, Mesopotamia and



(Left) A rare photograph—now first published—of night fighter Camels of No. 44 Squadron, Le Rhône-engined, and with the cockpit moved aft. Twin Lewis guns are carried on a special double Foster mounting. (Right) Installation of 150 h.p. B.R.1 engine in a Camel F.1

SOPWITH CAMEL . . .

Russia. The British and French Governments hastened to assist Italy after the débâcle at Caporetto on October 24th, 1917, and two days later it was decided to send a British detachment of troops together with No. 28 Sqn. (Sopwith-Camels) and No. 34 (R.E.8s). No. 28 reached Milan on November 12th, and by dint of day-and-night work had its Camels in the air by the 14th. Two more Camel squadrons, Nos. 45 and 66, followed a few days later. No. 66 Sqn. reached Italy on November 22nd and No. 45 arrived about a month later.

Normally, an escort of six Camels was provided for the R.E.8s of Nos. 34 and 42 Sqns., for enemy fighters energetically harried the two-seaters during November and December 1917. By January 1918 air superiority had passed to the Allies and the Camels began to make bombing attacks on enemy aerodromes. The first such attack, made against the aerodrome at Casarsa on February 19th, 1918, was so successful that Nos. 28 and 66 Sqns. each set aside four Camels for that specific duty. The three Camel squadrons sent 35 of their machines to bomb enemy hutments in the Val d'Assa on May 30th; and they dropped a ton of bombs and fired 9,000 rounds into the target area.

On October 4th, 1918, twenty-three Camels of Nos. 28 and 66 Sqns. attacked the Austrian training aerodrome at Campoformido. Of the ten 40-lb phosphorus and seventy-seven 20-lb bombs that were dropped, twenty-two scored direct hits. Two hangars containing ten new aeroplanes were demolished, and three of the defending fighters were shot down.

It was on the Italian front that the only Victoria Cross awarded to a Camel pilot was won. On March 30th, 1918, three machines from No. 66 Sqn. flown by Capt. P. Carpenter (15 E.A.) and Lts. H. Eycott-Martin and Alan Jerrard, attacked five Albatros Scouts. Jerrard shot one down in flames. The three Camels then attacked an Austrian aerodrome, and eventually the opposition totalled nineteen enemy fighters. Each of the Camel pilots shot down one, but Eycott-Martin was then attacked by eight of the enemy. Jerrard went to his aid, fought the enemy alone until his companions had made good their escape, and shot down another Austrian machine in doing so. Finally, with his own Camel riddled by the enemy's fire and his controls shot away, he was forced to land and surrender. For his heroic fight against great odds and his self-sacrifice he was awarded the Victoria Cross on May 1st, 1918.

On September 20th, 1918, No. 45 Sqn. left Italy and joined the Independent Force, R.A.F., two days later. It was intended that the Camels should escort the bombers of the Independent Force, but Maj-Gen. Trenchard decided not to use the squadron for escort duties until it had been re-equipped with Sopwith 7F.1a Snipes. The long-range Snipes were not delivered before the Armistice, however, and No. 45's activities were confined to front-line patrols.

The R.N.A.S. also used Sopwith Camels in Italy. The establishment of the base at Otranto included twelve Camels. Four of these machines escorted the D.H.4s of No. 224 Squadron in the attack on Durazzo on October 2nd, 1918, and more Camels patrolled over the town while the bombing attacks developed.

In the Aegean, F.1 Camels were flown by the R.N.A.S. from the islands of Thasos, Imbros, Mitylene and Lemnos, and in 1918 the type was in use with No. 221 Sqn., R.A.F. (as "D" Squadron, R.N.A.S., had become) at Stavros.

No. 150 Sqn. was formed in Macedonia on April 1st, 1918, and began operations with some S.E.5As, Bristol M.1Cs and Nieuport Scouts transferred from Nos. 17 and 47 Sqns. At the beginning of May a few Camels were delivered and were used by "C" Flight of the squadron, formed on May 7th, 1918. At the time of the Armistice No. 150 had seven Sopwith Camels.

A few Camels saw service in Mesopotamia, with No. 72 Sqn.

Some Camels went to Russia in 1918 and were flown against the Bolsheviks by the Slavo-British Aviation Group. Among the Russian pilots who flew the type was Capt. Alexander Alexandrovitch Kazakov. Kazakov's victory score is said to have totalled thirty-two enemy aircraft, several of which he shot down while flying a Camel. For his action at Siy Convent in October 1918 he was awarded the D.S.O. and promoted to the rank of major in the British Army. In those troublous times servicing and maintenance were doubtless sketchy, and on August 1st, 1919, Kazakov's Camel broke up in mid-air at 300ft above Bereznik aerodrome and the gallant Russian was killed instantly.

Six Camels were sent to Russia as reinforcements on November 12th, 1918, and on January 12th, 1919, No. 221 Sqn. arrived at Petrovsk with at least one Camel on its strength. It was flown by Maj. J. O. Andrews (24 E.A.).

The Sopwith Camel had an early introduction to Home Defence duties. On July 7th, 1917, some Camels were among the 95 British machines which took off to repulse the twenty-one Gothas which attacked London. The first Home Defence squadron to be equipped with Camels was No. 44, which began to exchange its Sopwith 1½-strutters for the new single-seaters in August 1917. The officer commanding this squadron was Maj. G. W. Murlis-Green, who had had a fine record with No. 17 Squadron in Macedonia. The pioneer night flights by Murlis-Green and two of his pilots have already been mentioned; they showed the way for future Home Defence work, for the enemy began to make night raids on September 2nd, 1917. Maj. Murlis-Green attacked a Gotha over Goodmayes on the night of December 18th, 1917. The flash of his guns temporarily blinded him and he was able to fire short bursts only. These sufficed to put one of the Gotha's engines out of action, but Murlis-Green lost sight of his quarry,

A B.R.1-powered Camel of No. 9 (Naval) Squadron, showing pilot's individual markings.

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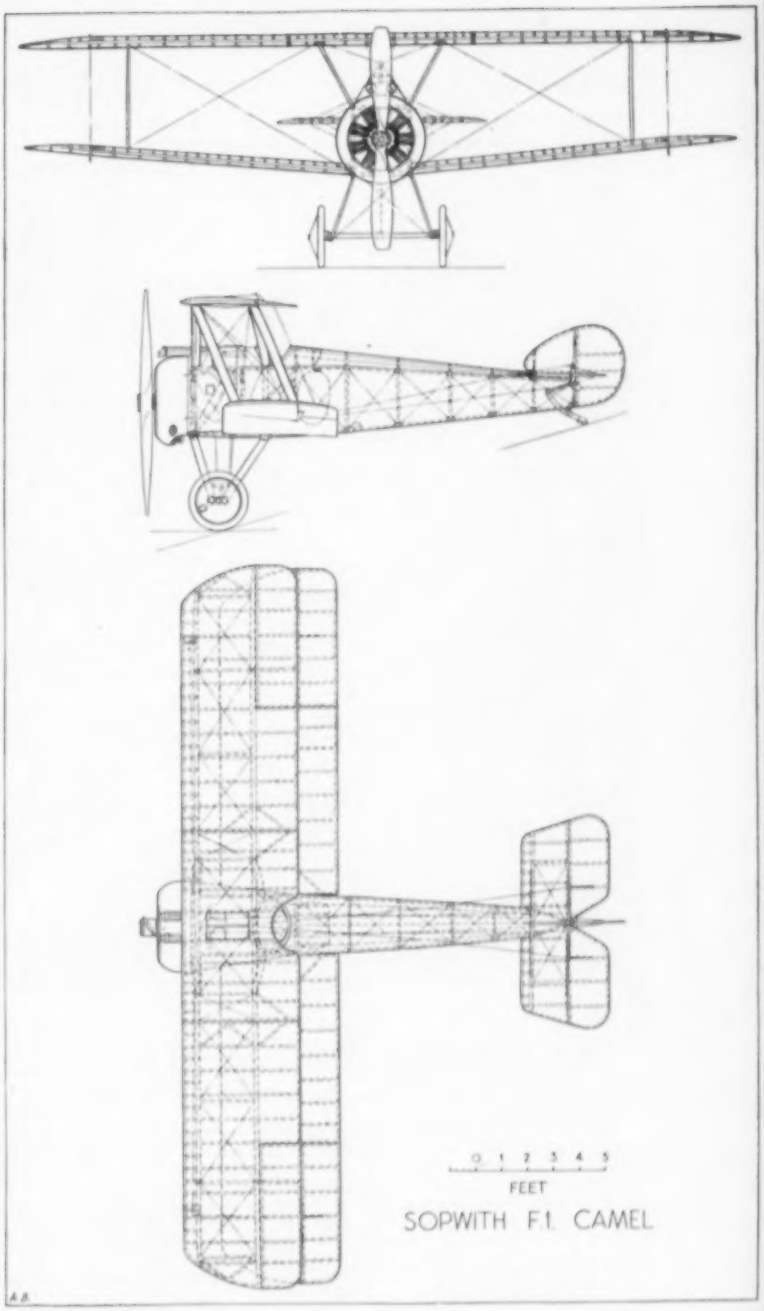

which pursued its course to drop its bombs on Bermondsey. On its homeward journey the Gotha's other engine failed and it came down into the sea near Folkestone.

Few other "firsts" in aerial combat were quite so significant as the victory scored by Capt. G. H. Hackwill and 2nd Lt. C. C. Banks, both of No. 44 Sqn., on the night of January 25th, 1918. In their Camels they closed with a Gotha they sighted near east London. They brought it down in flames at Frund's farm, Wickford. This was the first direct victory ever achieved in night combat between aeroplanes. It was effected without radar, without radio telephony, and with only the comparatively primitive aid of the Neame illuminated gun-sight.

Another of the three night-fighter pioneers, Capt. C. J. Q. Brand, put his early experience to good use on the night of May 19th/20th, 1918. He was then with No. 112 Sqn. At 8,700ft over Faversham he attacked a Gotha and shot it down in flames.

The Camels of the night-fighter squadrons were Le Rhône-powered, and many of them were modified to be more suitable for their specialized task. Since the twin Vickers guns of the standard Camel were so close to the pilot he was blinded by the flash when he fired them; moreover, there was a danger in firing explosive and incendiary ammunition through the airscrew. To overcome these difficulties the Camel night-fighters were armed with two Lewis guns on a special double Foster mounting above the centre section. To facilitate the re-loading of the guns and to enable them to be fired upwards at 45 degrees in the manner which had been proved to be so efficaciously accurate at Orfordness, the positions of the pilot and the main fuel tanks were interchanged. Thus the cockpit was one bay farther aft than on the standard Camel, and the pilot was behind the trailing edge of the upper wing. The centre section cut-out was enlarged, and some machines had cut-outs in the trailing edges of the lower wing-roots. These modifications gave the pilot a better all-round view but impaired the Camel's flying qualities to a certain extent.

At the end of the war it was official policy to equip all the Home Defence squadrons with Camels.

The night-fighting Camels contributed a good deal to the defeat of the Gothas over England. It is recorded that Major Freiherr von Bülow, the German authority, has said that the German bombing squadrons were withdrawn for more urgent work on the Western Front, and there can be little doubt that their withdrawal was expedited by the activities of the Home Defence Camels. The Gothas' operations in France occupied them exclusively from May 1918 onwards.

And where the Gothas were to be found, there also were the Camel night-fighters. For service on the Western Front, No. 151 Sqn. was formed from Home Defence Flights at Hainault in June 1918; the unit reached France on June 21st. From then until the opening of the British offensive on the Somme on August 8th, the squadron's principal duty was the night defence of the Abbeville area. Capt. A. B. Yuille scored No. 151's first success on July 23rd, when he damaged a Gotha-type biplane over Etaples and forced it down. On August 10th Yuille shot down a five-engined Giant, probably a Zeppelin R.XIV, in flames near Talmas.

When the British offensive began, No. 151 Sqn. moved to Vignacourt, and from there the Camels carried out missions which, in a later conflict, were to be known as night intruder sorties. On the night of August 21st/22nd, 1918, four of No. 151's Camels bombed the German aerodromes at Moislains and Offoy, and a pilot of the squadron shot down an enemy aircraft in flames near Arras. Three nights later, the squadron shot down two German night bombers; and on the night of September 17th/18th three more German machines fell to the Camels of No. 151.

In its five months of operational service in France the squadron shot down sixteen German bombers which fell in the British lines and ten which fell in the enemy lines; yet No. 151 itself suffered no battle casualties. This was a magnificent record in days when night-flying aids of any kind were virtually non-existent.

A second Camel night-fighter squadron, No. 152, arrived in France on October 18th, 1918. It was planned to send three more squadrons for night-fighting duties, but the Armistice intervened.

Of all the fine pilots who used the Sopwith Camel as an aerobatic mount, probably none exploited its astonishing manœuvrability more fully than a certain Capt. Armstrong of No. 44 Sqn. Waddon, Chingford, Netheravon, Kenley—all saw Armstrong's flying, most of which was done very low down. He could—and did—loop his Camel from ground level, and he specialized in flick rolls performed at about fifteen feet. It is recorded that on one occasion one of his Camel's wing tips brushed the grass while flick-rolling. Armstrong went to France with No. 151 Sqn., and there he was killed late in October 1918 when his Camel spun into the ground.

In the training schools casualties were heavy among pupils who went on to Camels. By the end of 1917 flying training had improved considerably, thanks largely to the adoption of the Gosport system of instruction which had been initiated by Maj. R. R. Smith-Barry (see *Flight*, July 16th, 1954, page 83). Pupils learned to fly on Avro 504Js and 504Ks, and it was then normal for them to proceed directly to Camels. The differences in handling characteristics between the two aircraft were so great, however, that many first solos on Camels terminated in fatal crashes. If the pupil had been accustomed to Avros with Monosoupape engines his difficulties increased, for the Camel's Clerget had two controls—a throttle and a fine adjustment petrol control—whereas the Monosoupape had only the latter. A characteristic of the Clerget was a tendency to choke at about 200ft after take-off; at

SOPWITH CAMEL . . .

that height a slightly leaner mixture was needed. Inexperienced pilots seldom reacted swiftly enough in this emergency; the Camel, tail heavy and at a low forward air speed, stalled almost immediately and spun in.

These difficulties probably led to the installation of Monosoupape engines in Camels, which were then used for training purposes. Official tests of the Monosoupape Camel were made in August 1917.

A development of even greater value was the dual-control version of the Camel. One of the first dual Camels was made about the middle of 1918 in the Aeroplane Repair Section of the 23rd Training Wing at South Carlton. It was converted from a standard single-seat aircraft by Capt. W. R. Roche-Kelly and was flying in the summer of 1918. By September 1918 dual-control conversions had appeared at several training stations, and their use effectively reduced the number of training accidents on Camels. The second cockpit was made immediately behind the normal one, and necessitated the removal of the main petrol tank. Since the rear seat was fitted at the point where the longerons began to converge, the cockpit was rather cramped. A head rest was fitted.

Camels were widely used for experimental purposes, and several experimental versions existed. One of the most interesting of these was a modified F.1 which had tapered wings. This consisted of a standard F.1 fuselage fitted with tapered mainplanes which were connected on each side by a single plank-type interplane strut reminiscent of the struts of the Sopwith Triplane. The taper-wing Camel was tested in May 1917 with the 130 h.p. Clerget engine, but its performance was not appreciably better than that of the standard Clerget Camel. It was also considered that its tapered wings would give rise to production difficulties, since all the ribs were of different sizes. The design was therefore abandoned.

The Camel was used so extensively for ground-attack work that it was only natural to build a special version for that particular job. The F.1 Camel B.9278, originally built by Boulton and Paul, was converted into the Sopwith TF.1 by removing the Vickers guns and replacing them by a pair of Lewis guns which fired downwards through the floor of the cockpit. A third Lewis gun was mounted above the centre section, and armour plate was fitted for the protection of the pilot. The designation TF signified "Trench Fighter." Although the Sopwith TF.1 did not go into production, it paved the way for the later Salamander.

In December 1917 official tests were carried out with an F.1 Camel powered by the 150 h.p. Gnôme Monosoupape engine. This powerplant was a development of the widely used 100 h.p. Monosoupape, and had an unusual form of control. A multi-position ignition switch was provided; this enabled varying numbers of cylinders to be cut out and thereby controlled the power output of the engine. This Camel was purely experimental.

Another experimental engine installation was that of the 180 h.p. Le Rhône rotary engine, which was also made in an F.1 airframe. This Camel was tested in February 1919, but its performance proved to be inferior to that of the B.R.1 Camel.

In experimental flying the Camel broke new ground in 1917 when it carried out the first tests to be conducted in the technique of dive-bombing.

During investigations into the spinning of aeroplanes, Camels powered with B.R.1 and 130 h.p. Clerget engines were used. For these experiments a Clerget Camel was fitted with a rudder of increased area, and the elevator area was later increased also.

Two interesting developments of the F.1 Camel were built in 1918. Both were monoplanes, the first aircraft of that configuration to be built by the Sopwith company. The first of the two machines was originally known as the Sopwith Monoplane No. 1, and appeared in June 1918. It was named the Scooter, and was powered by a 130 h.p. Clerget engine.

The Scooter consisted of an F.1 Camel fuselage fitted with a parasol wing which was mounted very close to the fuselage. Bracing was by Rafwires; the landing wires were attached to a tall pyramidal cabane. The machine provided Harry Hawker with an aerobatic mount, and after the Armistice it appeared on the Civil Register, first as K.135 and later as G-EACZ.

From the Scooter was developed the Swallow, a single-seat fighter originally designated Sopwith Monoplane No. 2; it appeared in October 1918. Like the Scooter, the Swallow was a parasol monoplane with a Camel fuselage (that of B.9276), but the armament was retained and the engine was the 110 h.p. Le Rhône. The Swallow's wing was of slightly greater span and area than that of the Scooter and was rather higher above the fuselage in order to give the pilot access to his guns, which were fully exposed and not partially covered as on the Camel. The centre section struts were longer than those of the Scooter and had a more pronounced outwards rake when seen from the front. The central portion of the wing was reinforced, and the ailerons were of longer span than those of the Scooter.

The Swallow arrived too late to be developed for Service use. The official trials conducted in May 1919 showed no improvement in performance over the Camel. *(To be concluded)*

SPECIFICATION

Power Plant.—*F.1 Camel:* 110 h.p. Clerget; 130 h.p. Clerget; 110 h.p. Le Rhône; 150 h.p. B.R.1; 100 h.p. Gnôme Monosoupape. *Experimental:* 150 h.p. Gnôme Monosoupape; 180 h.p. Le Rhône. *2F.1 Camel:* 130 h.p. Clerget; 150 h.p. B.R.1. [power figures are nominal.—Ed.]

Manufacturers.—Sopwith Aviation Co., Ltd., Canbury Park Road, Kingston-on-Thames.

Other Contractors.—*For F.1 Camel:* Boulton and Paul Ltd., Rose Lane Works, Norwich; British Caudron Co., Ltd., Broadway, Cricklewood, London; Clayton and Shuttleworth, Ltd., Lincoln; Hooper and Co., Ltd., St. James's St., London; March, Jones and Cribb, Ltd., Leeds; Nieuport and General Aircraft Co., Ltd., Cricklewood, London, N.W.; Portholme Aerodrome, Ltd., St. John's St., Huntingdon; Ruston, Proctor and Co., Ltd., Lincoln. *For 2F.1 Camel:* Wm. Beardmore and Co., Ltd., Dalmuir, Dunbartonshire.

Dimensions.—*Span:* F.1, 28ft; 2F.1, 26ft 11in *Length, F.1:* With Clerget, 18ft 9in; Le Rhône, 18ft 8in; B.R.1 and 150 h.p. Monosoupape, 18ft 6in; 100 h.p. Monosoupape and 180 h.p. Le Rhône, 19ft. *Length: 2F.1:* 130 h.p. Clerget, 18ft 6in; B.R.1, 18ft 8in. *Height, F.1:* 8ft 6in with Clerget, 110 h.p. Le Rhône, B.R.1 and 150 h.p. Monosoupape engine; 8ft 9in with 100 h.p. Monosoupape; 8ft 8in with 180 h.p. Le Rhône. *Height, 2F.1:* 9ft 1in. *Chord:* 4ft 6in. *Gap:* at fuselage (F.1) 5ft, (2F.1) 4ft 11⅛in. *Stagger:* at fuselage, 18in; at interplane struts, 18⅝in. *Dihedral:* Upper, nil; lower (F.1) 5 deg, (2F.1) 5 deg 30 min. *Incidence:* 2 deg. *Span of tail:* 8ft 2½in. Wheel track: F.1, 4ft 8in; 2F.1, 4ft 5½in.

Areas.—*F.1:* Wings: 231 sq ft. Ailerons: each 9 sq ft, total 36 sq ft. Tailplane: 14 sq ft. Elevators: 4.9 sq ft. *2F.1:* Wings: 221 sq ft.

Armament.—*F.1 Camel:* Standard armament consisted of two fixed, synchronized Vickers machine-guns mounted side-by-side on top of the fuselage and firing through the airscrew arc. Four 25-lb bombs could be carried in external racks under the fuselage. On at least one occasion the Camels of No. 213 Squadron each carried one 112-lb bomb, and 40-lb phosphorous bombs were also used occasionally. The Home Defence version of the F.1 Camel had two Lewis machine-guns above the centre section, firing forward over the airscrew. These Lewis guns were carried on a double Foster mounting.

TF.1 Camel: Two Lewis machine-guns in the floor of the fuselage, their barrels lying between the undercarriage vees. These guns fired downwards and forwards. A third Lewis gun was mounted above the centre section and fired forwards over the airscrew.

2F.1 Camel: One fixed, synchronized Vickers machine-gun mounted on top of fuselage, firing forward through the airscrew. One Lewis gun on Admiralty top plane mounting above centre section. At least one 2F.1 of the R.N.A.S. Station, Felixstowe, had twin Vickers guns as on the F.1 Camel. The 2F.1 Camels which bombed Tondern each carried two 50-lb bombs.

WEIGHTS AND PERFORMANCE

	F.1 Camel								Taper-wing	2F.1 Camel	
	130 h.p. Clerget	130 h.p. Clerget (long stroke)	110 h.p. Le Rhône	150 h.p. B.R.1	B.R.1 (compression ratio 5.7:1)	100 h.p. Gnôme Monosoupape	150 h.p. Gnôme Monosoupape	180 h.p. Le Rhône	130 h.p. Clerget	130 h.p. Clerget	150 h.p. B.R.1
Weight empty (lb)	929	—	889	977	—	882	930	1,048	950	956	1,036
Military load (lb)	281	—	281	281	281	281	281	281	280	281	271
Fuel and oil (lb)	243	—	252	250	—	224	230	238	252	286	223
Weight loaded (lb)	1,453	1,452	1,422	1,508	1,470	1,387	1,441	1,567	1,482	1,523	1,530
Maximum speed (m.p.h.) at:											
Sea level	—	—	122	—	—	—	—	—	—	—	—
6,500ft	115	—	—	116.5	—	—	—	—	—	—	124
10,000ft	113	—	118.5	111	121	110.5	—	113	112.5	114	122
15,000ft	106.5	113.5	111.5	103	114.5	102.5	113	108.5	106	104	117
Climb (min and sec) to:											
6,500ft	6 0	5 0	5 10	5 30	4 35	6 50	5 5	5 30	6 0	6 25	6 0
10,000ft	10 35	8 30	9 10	9 50	8 10	11 50	8 50	9 35	10 35	11 40	11 30
15,000ft	20 40	15 50	16 50	20 0	15 55	23 20	16 5	17 30	21 5	23 40	25 0
Service ceiling (ft)	19,000	24,000	24,000	18,000	22,000	18,500	22,000	21,500	19,000	19,000	17,300
Endurance (hr)	2½	—	—	2½	2½	2½	2½	—	2½	3	—

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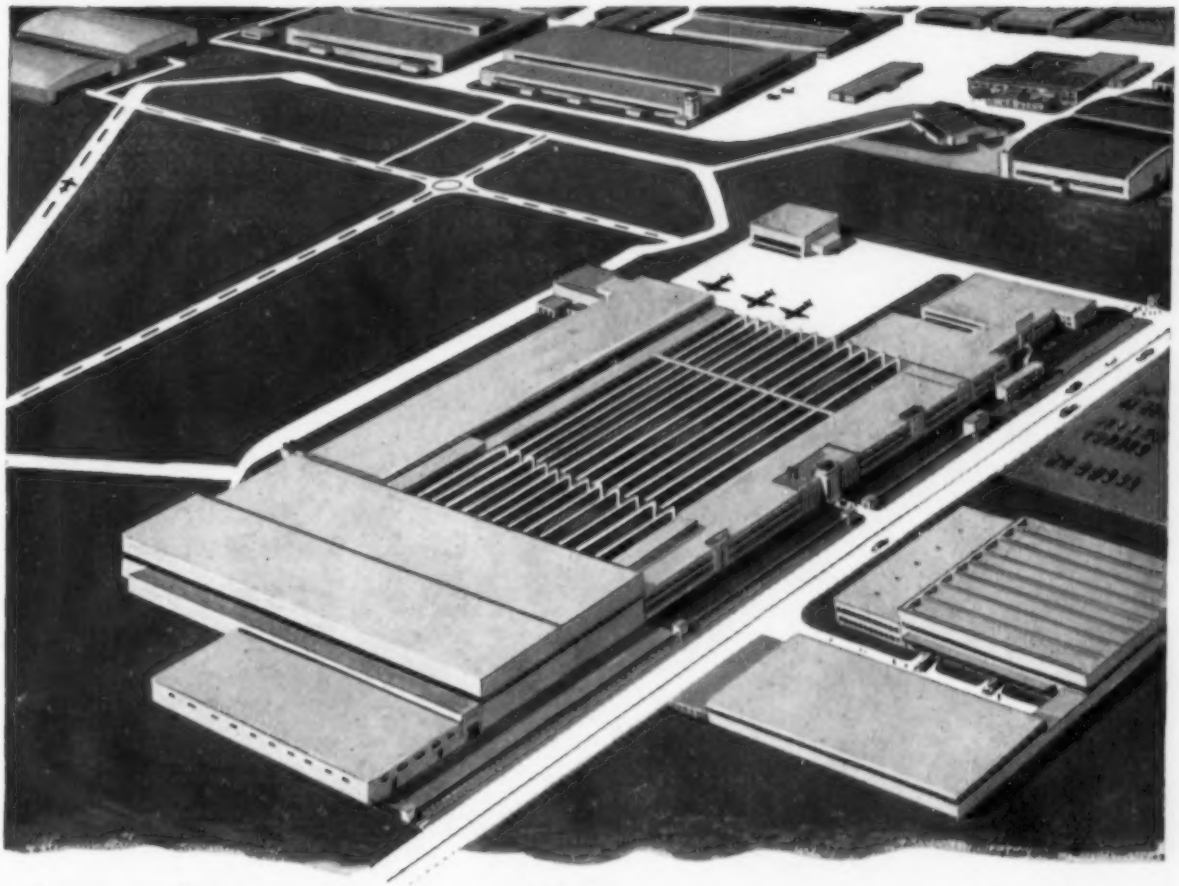

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The Speedy Fox

I READ with much interest your article "The Speed of the Fox" (April 8th) because my first posting on leaving Cranwell in 1929 was to No. 12 Squadron, and I always remember the Fairey Fox with esteem and affection. At that time S/L. "Sammy" Maynard was our C.O. and I was lucky enough to be posted to Henry Forrow's flight, which was the only one equipped with the Rolls "F" of almost 100 more h.p. than the Curtiss, and with geared props. If memory serves me aright, our indicated top-speed was 165 (definitely the fastest squadron in the Air Force) and we touched down with 65 on the clock ("like a bat out of hell, old boy"). Since there were no flaps or brakes, the tail-skid's friction was the only positive retarding influence as we darted across the rolling flatness of Andover; when I landed there recently in a modern aeroplane, I marvelled that we so seldom went through the hedge in our Foxes.

The Curtiss wing radiator which you mention did not have much drag—nor, for that matter, cooling effect. This had to be supplemented by a normal honeycomb radiator which wound in and out (by hand) from the belly of the aircraft. In theory one only had the drag of the fuselage radiator during take-off and climb; in level flight the pilot wound in the honeycomb so as to present a clean fuselage to the airstream. In practice a fairly large chunk of lower radiator had to be kept out except during glide or dive. The system involved too many pipes and the weight was excessive; moreover, if a pilot forgot to extend his radiator during a climb, the engine would boil and it was virtually impossible to retrieve the situation without landing.

Aerobatics involving sustained inversion were not permitted because we had neither shoulder-straps nor oil systems designed for the purpose. I remember returning from a daring cross-country flight (under the exclusive auspices of Bradshaw) with a rather dull observer whose reading of railway station names had proved none too reliable. I announced at 4,000ft over Andover, "I am going to do a loop," to hear the rejoinder, after a brief pause, "This is Andover, sir"—the first place he had recognized since take-off.

To pilots like myself, the Fox will always be a happy memory but for the Royal Air Force its significance has been far more than that. The enterprise and initiative of Mr. C. R. (now Sir Richard) Fairey in buying the Curtiss licence had repercussions throughout the British Aircraft Industry, and gave rise to a marked improvement in performance of our military aircraft, deriving from the cleanness of the Fox.

London, W.1. JOHN GRIERSON.

Veteran DC-2s

THE correspondence column of *Flight* dated December 3rd, 1954, contained a letter from Mr. Dennis M. Powell concerning the remaining DC-2s. Information supplied from Mr. Rauha Vuorinen, technical secretary of Finnair (Aero O.Y.) enables me to supplement and correct the information given by Mr. Powell. These two DC-2s have been used by Finnair:—

OH-LDA (constructors' number 1582). Originally delivered to Czechoslovakia as OK-AIB, later taken over by the Germans as D-AAIB. Bought by Aero O.Y. in 1941 and named *Voima*. Sold to the Finnish Air Force in 1949 as DO-2.

OH-LDB (constructors' number 1562). Originally OK-AIO, later D-AAIO. Also bought 1941 and named *Sisu*. Sold 1949 to the Finnish Air Force as DO-3.

One of these aircraft crashed in 1951. The remaining aircraft has now been fitted with Bristol Mercury VIII engines.

The Finnish serial DO-1 is no doubt carried by the old K.L.M. aircraft PH-AKH (constructors' number 1354). This aircraft was bought by the Finns in 1939 and converted to a bomber by Saab at their Trollhättan factory. During the war it was fitted with Russian M-62 engines.

Copenhagen. H. A. KOFOED.

Service Flying Clubs

I HAVE recently re-read your leading article (July 30th, 1954) on the official R.A.F. attitude to the formation of small powered-flying clubs for the benefit of non-rated pilots. Subsequent correspondence on the subject, from the Naval side of aviation, gives the impression that ground staff are on the whole not interested in ever feeling the real thrill of flying for themselves.

I would like to take this opportunity of refuting this allegation. In No. 47 Squadron, Royal Air Force, a small but thriving club is even now flying its own Hawk Major ten hours per month.

The club is open to any members of the squadron and/or R.A.F. Abingdon, at a cost of 30s a year subscription. Flying rates are 35s per hour for R.A.F. Abingdon members and 30s per hour for No. 47 Sqn. members. The total number of members, at the time of writing, is 50.

The keenest squadron members are not, as might be expected, aircrew, but rather corporals and airmen who can, if they wish, learn on a "pay as you fly" system, much in vogue with a larger concern than ours!

The official Air Ministry attitude to our small club has always been one of encouragement, though they very correctly insist on our aircraft being loaded with a third-party liability of £50,000, which has been expensive.

The club has only been in existence three winter months, but already it is hoped to prove, by internal aircrew recruiting, that official financial assistance in the form of a subsidy on flying hours completed would pay an enormous dividend. The added bonus in the morale of a squadron owning its own private aircraft must be seen to be believed.

For any Service reader who may be interested, a full article on how to form such a club is contained in the April issue of *Air Clues*.

Royal Air Force Abingdon. D. P. BOULNOIS.

The Parnall Prawn

REGARDING the letter from P. M. H. Lewis concerning the Parnall Prawn, this little flying-boat is illustrated in Taylor and Allward's book *Wings for Tomorrow* with the engine in the lowered position. Again there is no mention of this machine in the text, but the caption to the photograph states that the aircraft was built in 1930 and the 65 h.p. A.C.-Ricardo-Burt engine was a spare auxiliary engine from the airship R.101. The reason given for pivoting the engine was to raise the airscrew clear of spray during take-off.

Weymouth, Dorset. W. O. DOYLEND.

Sky Riddle

OF the many aeronautical phenomena which occur from time to time, I have only twice experienced one to which I have never been able to assign a satisfactory explanation. I would like to know if you or your readers can offer one.

The first manifestation took place about ten months ago, at 1230 hours on a bright day, in a slightly hazy sky. Several Canberras were passing over, northwards. Before the aircraft were visible, however, I noticed darker, straight lines in a north-south direction; and when they appeared, the Canberras, which were showing condensation trails, followed these lines exactly.

My first reaction was to dismiss the lines as some form of shadow, but this theory was confounded when an aircraft coming from the south-east passed overhead, and on contacting a line, turned on to and followed it, whilst others were seen to cross from one line to another.

I have a friend who can bear out my account, and I have again seen the lines, under slightly different conditions of time.

Enfield, Middlesex. D. NASH.

FORTHCOMING EVENTS

Apr. 23. British Interplanetary Society (Provisional Yorkshire Branch): "History of Rocketry," by L. S. Strickson.
Apr. 24. Denham Flying Club: Tea patrol.
Apr. 25-28. Physical Society Exhibition: Royal Horticultural Society's New Hall, London, S.W.1.
Apr. 26. Institute of Transport: Informal luncheon.
Apr. 26. R.Ae.S. Section lecture: "Aerial Systems for Aircraft," by R. A. Burberry.
Apr. 30. R.Ae.C.: First National Air Races meeting, Fairwood Common, Swansea.
Apr. 30. Institute of Welding: "Oxy-acetylene Pressure Welding of Aircraft Undercarriage Components," by J. J. Wilson and D. C. Brown.
May 2-13. British Industries Fair: Olympia, London, and Castle Bromwich, Birmingham.
May 3. R.Ae.S. Section lecture: "Plastic Structures," by G. C. Hulbert, B.Sc.
May 4. Royal Society of Arts: Trueman Wood Lecture: "New Ways of Flying," by Maj. O. Stewart, M.C., A.F.C.
May 4. R.Ae.S. Graduates and Students Section: "Technical Aspects of Supersonic Aircraft Design," by E. J. Catchpole, M.S. in Ae., B.Sc. (Eng.), M.I.A.S., Grad. R.Ae.S., and W. J. Egginton, B.Sc., Grad. R.Ae.S.

R.Ae.S. Branch Fixtures (to May 9)

April 26, *Boscombe Down*, "The Light Fighter," by W. E. W. Petter. April 27, *Gloucester*, Annual general meeting and film show. April 28, *Yeovil*, Annual general meeting. May 4, *Luton*, "Rubbers in Aircraft"; *Weybridge*, Annual general meeting. May 9, *Halton*, "The History of Parachuting and Ejector Seats," by R. D. Trender.

Idlewild's New Terminal Area

PLANS for an international air terminal costing more than £20m were completed recently by the Port of New York Authority. The terminal will be located at the existing airport of Idlewild, which handles the bulk of New York's international air traffic and much of the long-haul domestic services. Idlewild's official title is, in fact, New York International Airport, though the earlier name is still widely used.

As at London Airport, passengers travelling to and from New York International have been "processed" in temporary buildings. To the extent that permanent buildings are situated at the centre of their respective runway patterns, the two airports are taking a similar approach to the common problem of handling increased traffic. But whereas, initially at least, all London traffic will be served by two or three terminals maintained by the airport authorities, the P.N.Y.A. plan for New York International envisages the construction of eight terminal buildings, seven of which would be operated by individual airlines.

The largest of the new structures, to be operated by the Port Authority itself, will be the International Arrival Building and its adjoining Airline Wing Buildings. Services of non-American airlines will be centred on this point.

United States carriers, including American, Eastern, PanAm and Trans-World, will operate the seven individual terminals, whose position relative to the main building is illustrated below. Virtually the only part of the new terminal area actually in existence is the 150ft, eleven-storey control tower, though preliminary work on other sections has begun.

Statements welcoming the P.N.Y.A. plan have been issued by some of the airlines directly concerned. One, Eastern Air Lines, recalled the construction at Miami, at company expense, of a separate terminal capable of handling 19 Super Constellations, adding that but for these expanded facilities the airline would have been unable to develop traffic in the area to its present volume.

With its associated roads, taxiways and aprons, the new Idlewild terminal area will cover 655 acres—105 acres more than the *total* area of La Guardia Airport and more than four times as large as the central area at London Airport (158 acres). It will have loading positions for 140 aircraft, and the floor area of the passenger buildings will exceed 1m sq ft.

New York International is the best-known, though not the busiest, of the four airports serving the New Jersey/New York region. The terminal development plan expresses the P.N.Y.A. policy of allocating an increased share of traffic to Idlewild. Last year the four airports—Idlewild, La Guardia, Newark and Teterboro—handled over 600,000 aircraft movements and 9,300,000 passengers, of whom the vast majority travelled on scheduled services. Busiest of the four was La Guardia, which had a take-off or landing every three minutes (round-the-clock average) and handled nearly 5m passengers last year. This one airport, incidentally, deals with more passengers and mail than all United Kingdom airports combined.

Passengers arriving at or departing from Idlewild in 1954 totalled some 2.9m, of whom one-third travelled on overseas flights. Newark handled nearly 1.5m passengers. The fourth airport, Teterboro, does not handle passengers in the commercial sense, though in terms of movements (by business, private and training aircraft) it was even busier than La Guardia in 1954.

Some 1954 traffic statistics for leading European airports will lend perspective to the New York figures quoted above. Last year, British airports handled some 4,390,000 passengers, of whom 2.4m used airports in the London area: of these, London Airport handled 1.7m passengers, and Northolt (now closed), not quite half-a-million. The two major airports of Paris handled 1.75m passengers, of whom two-thirds travelled *via* Orly and the remainder through Le Bourget. Schiphol, international airport of the Netherlands, handled 616,000 passengers.

The P.N.Y.A. proposes, ultimately, to concentrate at Idlewild all overseas traffic to and from the New York region, together with half of long-haul U.S. domestic traffic, a third of domestic cargo traffic and a quarter of domestic short-haul traffic. La Guardia will take about half of short-haul domestic and 10 per cent of domestic cargo flights. Remaining scheduled domestic traffic will go to Newark, and Teterboro will continue in its present role.

Passenger traffic at Idlewild is thus expected to increase from 3m to 4m annually within the near future, and by 1965 the total is expected to pass the 8m mark.

Between 1942 and 1948, when the airport was opened to commercial traffic, the City of New York spent $60m (£21m) on the construction of Idlewild. The airport was taken over on a 50-year lease by the Port of New York Authority in 1948 (the other three metropolitan airports were taken over on the same basis at approximately the same time). At December 31st, 1954, the Port Authority had spent or committed a further $66.5m (£24m) on the one site at Idlewild. Approximate cost of the new terminal facilities described here will be $60m, of which some $30m will be accounted for by the unit terminal buildings for individual airlines. These figures, incidentally, do not embrace all items of expenditure on New York International Airport; many other features have been added at private expense.

The proposed central terminal area at New York International Airport is shown here in model form. In addition to the main terminal for overseas airlines (right), seven "unit terminals" will be operated by American companies. "Finger-type" walkways, each with eight or more gates, will extend radially on to the apron, enabling passengers to make their own way to and from any of 140 aircraft parking-positions.

CIVIL AVIATION

LOCKHEED'S BIG T.W.A. ORDER

THE battle for the favours of the long range airlines took a new but not entirely unexpected turn on Tuesday, April 19th, when the Lockheed Aircraft Corporation announced a T.W.A. order for twenty-four L.1649As. Claimed to be the most valuable single order ever placed for a commercial aircraft, the contract is worth $70,000,000 (£25,000,000).

Introduction of the L.1649A is expected to take place in the spring of 1957, by which time T.W.A.'s major overseas competitors will be offering non-stop transatlantic services with their DC-7Cs. The former company's preference for Lockheed equipment is explained largely by the fact that it operates the largest Constellation fleet in the world.

The L.1649A might be described as Lockheed's answer to the DC-7C. Essentially, it is a Super Constellation with an entirely new wing housing additional fuel and enabling the engines—3,400 h.p. Wright Turbo-Compounds—to be situated further from the cabin. Its span will be 150ft—27ft greater than that of the existing L.1049—and the wing will be 15 per cent thinner. Wing area will be increased by 200 sq ft to 1,850 sq ft, and thickness-chord ratio will be some 15 per cent lower. Mr. Howard Hughes, president of T.W.A.'s parent company, has claimed that the new transport will be the fastest, longest-ranged piston engined civil aircraft in the world. In luxury form it will be able to carry 58 passengers over a distance of 6,500 miles at a cruising speed "in excess of 350 m.p.h."

As reported in *Flight* for February 25th, T.W.A. were until recently considering purchase of the projected L.1549 powered by four 6,000 h.p. T.34 turboprops, but in other respects similar to the 1649A. Lockheed now state that development delays on the T.34 have caused the turboprop Super Connie to be "ruled commercially impracticable at this time."

U.A.L.: "JETS IN FIVE YEARS"

IN announcing an order for 26 new Douglas transports, Mr. W. A. Patterson, president of United Air Lines said last week that the aircraft were required for interim expansion of capacity pending the introduction of jet transports. By implication, Mr. Patterson refuted earlier reports that United were immediately placing a large order for the projected Douglas DC-8 when he said: "It is our feeling that jet transports cannot be expected until about 1960."

Before the announcement of last week's order, United had already signed contracts for two DC-7s, ten DC-6Bs and five DC-6As for delivery in 1956. The additional aircraft—15 DC-7s and 11 DC-6Bs—will be delivered in 1957. Mr. Patterson said that the extra DC-6Bs would be employed on stages now served by Convairs which in turn would replace all the company's DC-3s by 1957.

Approximate cost of the 43 Douglas aircraft now on order for United is quoted as $64,800,000 (£23,141,000) by the company's president. This sum is made up as follows: for delivery in 1956, 17 aircraft at $22,300,000 (£7,965,000); for delivery in 1957, 15 DC-7s at $1,902,000 (£679,300) each and 11 DC-6Bs at $1,270,000 (£453,600) each.

Earlier, Mr. Patterson had announced United's signature to a $2,500,000 (£892,600) contract with the Radio Corporation of America for 200 airborne radar units. This decision will make United the first airline in the world to fit its entire fleet with C-band (5.5 cm) radar as standard equipment. Current fleet strength of the airline is 178 aircraft. The estimated cost of modifying the aircraft and installing the radar—work which will be performed at the company's San Francisco maintenance base—is $1,500,000 (£536,000). The first radar-equipped "Mainliners" will enter service in the autumn.

THE INDIAN CONSTELLATION CRASH

WHAT reallly happened to the Air India International Constellation VT-DEP which fell into the sea off the coast of Sarawak on April 11th still remains obscure.

The aircraft had been chartered to carry members of the Chinese Communist delegation to the Afro-Asian conference and had left Hong-Kong for Djkarta. Shortly after 9 a.m. G.M.T. two "Mayday" signals were heard, and it was soon afterwards established that the aircraft had ditched at a position 4° 30′ N, 180° 20′ E. An air and sea search was immediately instituted and three slightly injured survivors of the Constellation's complement of 18 were picked up by the frigate H.M.S. *Dampier*.

Next day, the Communist New China news agency issued a statement of the Chinese Foreign Ministry alleging that the accident "was a murder deliberately engineered by secret agency organizations of the United States and Chiang Kai-Shek."

The accusation of sabotage was repeated in a Note from the Chinese Government, in which it was stated that the Foreign Ministry had informed the British chargé d'affaires in advance of plans to sabotage the aircraft.

In its reply, the British Government said that the authorities in Hong-Kong took all steps to ensure the safety of the passengers. The reply went on to describe in considerable detail the arrangements made for handling passengers and luggage. The aircraft was under police guard.

It seems unquestionable that a fire, or an explosion and fire, caused the accident. Air India International, in a statement issued on April 17th, said that the three survivors of the crew "are of the opinion that the explosion and fire which caused its loss emanated from an extraneous source wholly unconnected with the structure of the aircraft". The statement went on to say that according to the survivors the Constellation was flying normally at about eighteen thousand feet near Natuna island when there was a muffled explosion and white smoke began entering the cabin through air ducts. The baggage compartment fire warning came on.

In a message datelined Singapore April 13th, *Lloyd's List and Shipping Gazette* quotes one of the survivors—H. S. Carnik, a ground engineer—as saying that the Constellation crashed "because of hydraulic fire in the port wing."

LUFTHANSA AT LONDON

ILLUSTRATED on page 510 is the first German civil aircraft to visit Britain since the war—one of the four Convair 340s of Lufthansa, the revived German airline. Registered D-ACAD, the aircraft is one of four now used on German internal routes and due for introduction to international short-haul work on May 16th. From that date, the German Convairs will be seen at London Airport twice daily; flights will connect London with Munich and Frankfurt, and Hamburg and Dusseldorf.

The aircraft which visited London last week (on a training flight from Hamburg) exhibited the standard 44-seat cabin. A notable feature of the attractive powder-blue and grey cabin included several pairs of roof-mounted loudspeakers for the public address system. Access to the cabin is normally by way of the forward port door, which incorporates a retractable staircase of impressively solid construction. The flight deck, laid out for two-crew operation, has earned high praise from Lufthansa pilots—British and German alike.

There were 4,000 applications from would-be Lufthansa pilots of whom 60 have been accepted and 20 trained. Initial command will be vested solely in nine B.E.A. captains, who have been seconded to the airline for one year. No fixed date has been set for the up-grading of German first officers, which will be determined on proficiency and experience. T.W.A. pilots will command Lufthansa's L.1049G Super Constellations, eight of which have been ordered for long-range services. The first of this fleet, which are of extra-long-range type with wing-tip tanks, was delivered to Hamburg on Friday last, April 15th. Scheduled services between Hamburg and New York begin on June 8th.

OVER THE POLE FROM CANADA

THE first flight by a Commonwealth airline over the Polar route over North America and Europe was completed on April 12th, when a DC-6B of Canadian Pacific Airlines arrived at London Airport from Vancouver. Aboard the aircraft were 48 members of the Vancouver Board of Trade (the largest single trade delegation from Canada to the United Kingdom), which chartered the flight at an approximate cost of £280 per head (round trip). The crew of eight are portrayed overleaf.

The DC-6B covered the 5,000 miles from British Columbia in 16 hr 35 min, cutting the usual time by about 6 hr and the distance by 1,000 miles. The flight made a single refuelling stop of 2 hr at Sondre Stromfjord, Greenland.

C.P.A.'s regular Polar service from Vancouver to Prestwick and Amsterdam will be inaugurated in June.

The Hon. Ralph Chetwynd, Minister of Trade and Industry in the Government of British Columbia, told *Flight* last week that the service is likely to have an important influence on trade between Britain and British Columbia. As a start, the trade delegation—whose members represent every branch of industry—had come to Britain with a view to placing between $10-20m-worth of orders. The first scheduled services were booked up for several weeks ahead; C.P.A. expected to attract a continuing flow of business travellers in both directions. Emphasizing the directness of the new link between Britain and British Columbia, Mr. Chetwynd added that he expected to leave London in the DC-6B tomorrow, April 23rd, at 7 a.m. and to be in Vancouver by 7 p.m. (local time) after 19 hr travelling.

In addition to the Vancouver-London charter flight by the DC-6B, C.P.A. also operated a familiarization flight with a DC-4, carrying 15 crew, which arrived in London on April 13th.

Portrayed on arrival at London Airport on April 12th are the crew of the first Commonwealth airliner—a C.P.A. DC-6B—to cross the Atlantic via the Polar route: (left to right) Capt. R. B. Leslie, Capt. W. Smith, 1st/Off. A. Weatherbe, Stewardess E. Donnelly, W/O. E. C. Kendall, Stewardess M. Metcalf, W/O. A. L. King and Steward van Hove. A note on the flight appears on p. 535.

CIVIL AVIATION . . .

T.A.A. VISCOUNT NEWS

A SEVENTH Viscount has been ordered by Trans-Australia Airlines to replace the aircraft lost in a training accident on October 31st last year. Delivery is expected towards the end of the year. An official inquiry into the accident decided that it was caused by the aircraft becoming airborne at less than the three-engine minimum control speed (about 96 kt). The pilots' limited experience of the Viscount was mentioned as a contributory cause. An official statement on the accident emphasized that the three-engine take-off is a training exercise, intended to give crews the experience necessary to make three-engined ferry flights.

T.A.A.'s regular Viscount services—on the Melbourne-Sydney-Brisbane route—began on December 18th. By January 11th the three aircraft then in service had made a total of 190 flights carrying 7,520 passengers out of a possible 8,320—representing a load factor of 90.4 per cent, one of the highest ever recorded in Australia. With the delivery of a fourth aircraft the number of Viscount passengers passed the 10,000 mark within a month of the type's introduction. In Australia Viscounts are expected to set up new airline records on many Australian routes. Most existing records are held by Convair 240s, and Viscounts have reduced average Convair schedules by 12 to 14 per cent.

BREVITIES

TURNOVER at the I.A.T.A. Clearing House in London reached a total of just over £102,300,000 in 1954, an increase of 19 per cent on the previous year's figure. Nearly 90 per cent of the interline transactions which made up this sum were settled by credit or debit offset rather than cash payments.

* * *

Weekly Super Constellation services on the Sydney-Tokyo route will be introduced on May 3rd by Qantas Empire Airways.

* * *

From June 1st PanAm's DC-6B services between London, Detroit and Chicago will operate on a daily frequency. The present frequency of three return flights weekly is due to increase to five from April 24th.

* * *

The total number of passengers carried on B.E.A. Viscounts reached the 500,000 mark on April 6th. The "official" half-millionth passenger travelled on a Clansman service from London to Renfrew.

* * *

The 100th scheduled service on the S.A.S. Arctic route was completed by DC-6B *Bernt Viking* when it arrived at Los Angeles from Copenhagen on April 9th.

* * *

An unusual form of pool agreement took effect on April 17th when K.L.M. began the operation of a thrice-weekly Brussels-Geneva service on behalf of Swissair. The Convairs which operate the service are manned by K.L.M. crews but carry a Swissair stewardess.

* * *

The Viscount 737 recently delivered to the Canadian Department of Transport is the first to be fitted with the new Smiths SEP.2 electronic autopilot. Before the Viscount left for Montreal the autopilot was test flown and demonstrated to the A.R.B. inside a period of three days. The demonstrations included fully automatic approaches down to 200ft with the autopilot coupled to the I.L.S. equipment.

* * *

Eagle Aviation announce that their weekly Viking service from Blackbushe to Belgrade will be resumed on June 11th. Flights will leave Blackbushe on Saturdays, returning from Belgrade on Sundays.

* * *

Canadian Pacific Airlines are reported to be seeking traffic rights between New Zealand and Australia. Discussions on the development of trans-Pacific services are at present being held between Australasian and Canadian Government officials.

* * *

On the occasion of his first visit to the Belgian Congo, extending from May 15th to June 6th, King Baudouin of Belgium will travel to and from the Congo by Sabena. The aircraft chosen for the royal flights—a DC-6—is now being specially equipped for the purpose in the airline's workshops at Melsbroek, Brussels.

* * *

To bring their Viking fleet up to strength (one aircraft was damaged beyond repair in a recent accident), Central African Airways have recently purchased an ex-B.E.A. Viking. Registered VP-YNF, the aircraft is expected to leave London for Salisbury at the end of this month, operating a scheduled service with passengers and freight.

* * *

Tourist-class Stratocruiser services were inaugurated by B.O.A.C. on April 13th on the London-Montreal route. Replacement of Constellations by Stratocruisers on all services to Canada will be completed by the end of this month, and by early July Stratocruisers will also have taken over all services to the United States.

* * *

A notable feature of the Aer Lingus summer service is the use of Viscounts on all scheduled services between London and Dublin, including the off-peak "Dawnflights" and "Starflights". The service frequency of 34 return flights weekly will increase to 64 during the July/August peak period.

* * *

Sir Miles Thomas, chairman of B.O.A.C., left London Airport on April 15th for a two-week tour of Africa. During his tour, which will include Nairobi, Salisbury, Livingstone, Bulawayo, Fort Victoria and Johannesburg, Sir Miles will have preliminary discussions about the introduction of Britannias next year on African routes.

* * *

The Bell Aircraft Corporation has begun delivery of the Lycoming-powered model 47G helicopter, for which orders have reached a total value of £90,000. By comparison with the standard 47G, which has a 200 h.p. Franklin engine, the new model has a 260 h.p. Lycoming derated to 200 h.p. for take-off; it can operate continuously at this rating at heights of over 5,000ft.

"Flight" photograph

Two crews were aboard the Lufthansa Convair 340 which visited London on April 15th (see also pp. 510 and 535): (left to right) 1st/Off. M. von Kardorff, 1st/Off. G. H. Pahnke, Chief Stewardess Ursula Tautz, Steward G. Hackbart, Capt. J. G. Simpson and Capt. P. J. McKeown (two of nine B.E.A. captains seconded to Lufthansa for one year).

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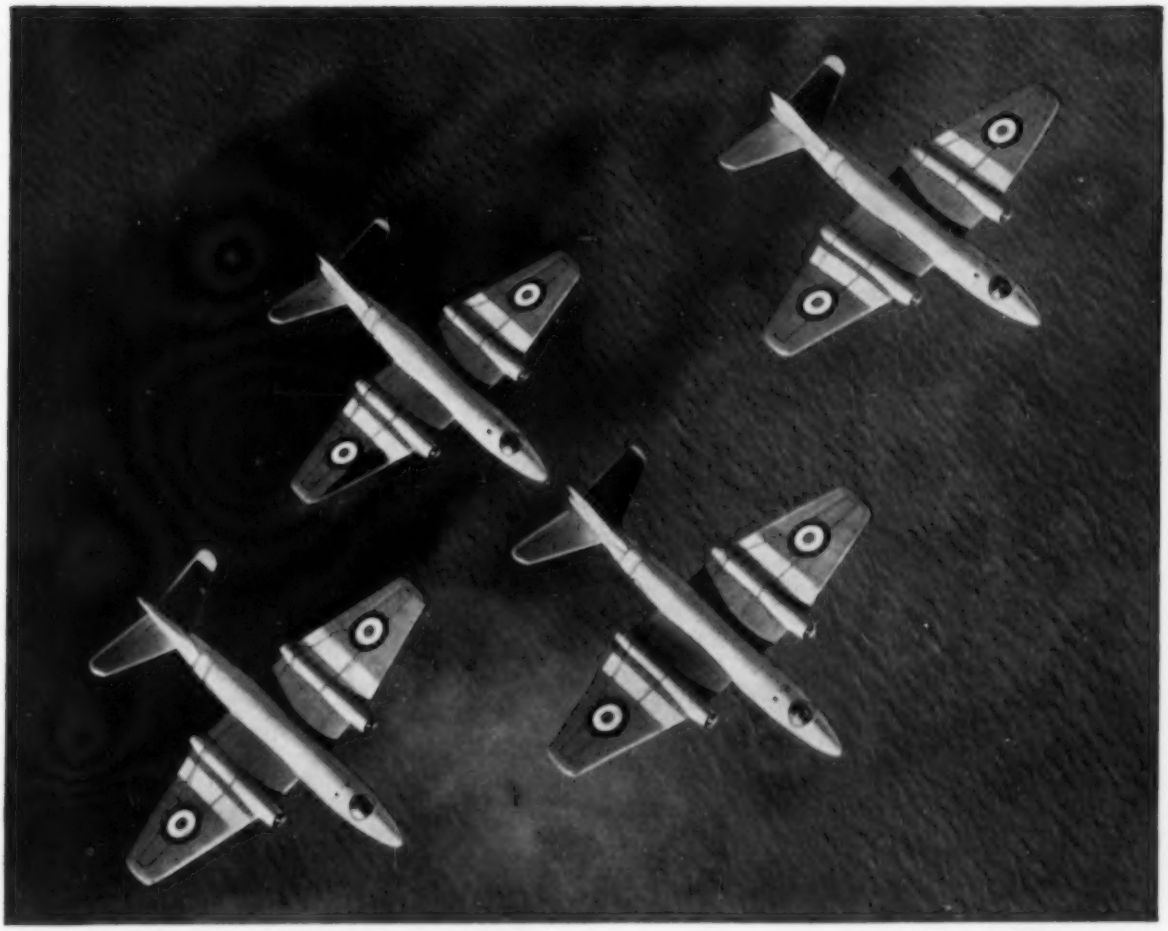

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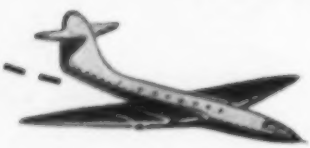

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SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Good Wishes to Sir Winston

THE Secretary of State for Air, Lord De L'Isle and Dudley, V.C., sent the following message to Sir Winston Churchill on the occasion of his retirement:—

"On behalf of the Air Council and all ranks of the Royal Air Force I send you, on your retirement from the office of Prime Minister, best wishes for your health and happiness. The Royal Air Force recalls with gratitude your long association with the Service as Secretary of State for Air, and as Prime Minister and Minister of Defence during the late war.

"It is proud to know that as Honorary Air Commodore of No. 615 Squadron of the Royal Auxiliary Air Force this association will continue."

No. 33 Squadron's 5,000th Sortie

FROM Butterworth, Malaya, S/L. N. P. W. Hancock, D.F.C., recently flew the squadron's 5,000th Hornet sortie since the campaign against the communists there began. Accompanied by F/L. M. F. Crow and F/O. M. T. Duck, S/L. Hancock flew a strike against a large communist encampment in Kedah, dropping bombs and firing rockets and cannon. During a recent week of intensive operations the squadron flew 231 sorties.

Halton's 71st Entry Passes Out

THE 71st Entry to No. 1 School of Technical Training, Halton, passed out on April 6th. The reviewing officer at the parade was Sir Henry Aubrey-Fletcher, D.S.O., M.V.O., Lord Lieutenant of Buckinghamshire, and he was accompanied by Air Marshal Sir Victor Groom, K.C.V.O., K.B.E., C.B., D.F.C., A.O.C-in-C., Technical Training Command. The parade commander was Flt. Sgt. App. A. E. Thomson and the Queen's Colour was borne by Sgt. App. F. O. Hutchings.

The award winners and their awards are seen in the illustration below, and the orders of merit were as follows: highest in order of merit, all subjects, Sgt. App. F. O. Hutchings; highest in order of merit, educational subjects, Sgt. App. F. O. Hutchings; highest in order of merit, general service efficiency, Flt. Sgt. App. A. E. Thomson; the highest average for practical fitting over the three-year course was attained by Cpl. App. J. E. Hughes.

Jungle Survival Pack Tests

NEW jungle survival equipment is being tested in the sea and jungle areas around Singapore by S/L. G. A. Podevin, Command Physical Fitness Officer, F.E.A.F.

Early trials entailed a fifteen-foot jump into the sea at Loyang, Singapore, after which dinghies were inflated and paddled ashore. The equipment was then dried and then S/L. Podevin and F/L. P. Woodruffe marched 12 miles into the jungle on Singapore Island and camped there for some days. Shortly after this, four instructors parachuted into the sea from a Valetta, boarded dinghies and ascertained how much the 26 lb survival pack had been affected by immersion in tepid sea water.

R.A.F. Farming Year

DESPITE the bad weather, 1954 was a good year for station farms in the U.K.; 132 farms worked a total of 2,638 acres and sold produce for £452,469. No less than 7,531 tons of vegetables, fruit and cereals, 17,857 pigs, 9,469 table birds and 47,339 dozen eggs were produced.

Auxiliary F.C.U. Appointment

THE R.Aux.A.F. Fighter Control Unit at Norwich, No. 3620 (County of Norfolk), is to be commanded by S/L. R. T. Britton.

S/L. Britton enlisted in the R.A.F.V.R. in 1940 and flew with bomber squadrons as a wireless operator/air gunner until 1945. Up till his release in 1946 he served as an instructor with No. 1336 Transport Support Conversion Unit. He rejoined in 1947 and took up fighter control duties.

The prize-winners of the 71st Entry of apprentices at Halton after the passing-out parade (see above). Left to right: Flt. Sgt. App. A. E. Thomson, Monsignor Beauchamp Memorial Prize; Air App. R. L. Dodd, Pioneer Trophy and Crebbin-Robinson Cup; Sgt. App. P. G. Turner, Elliott Memorial Prize; Sgt. App. H. Gordon, Quinton Memorial Trophy; and Air App. M. S. Islam, Azhar Memorial Shield. Flt. Sgt. App. Thomson is a New Zealander and Air App. Islam comes from Pakistan.

A.V-M. A. W. B. Mcdonald, C-in-C. designate of the Royal Pakistan Air Force (see below).

New C-in-C. for R.P.A.F.

TO succeed A.V-M. L. W. Cannon, A.V-M. A. W. B. Mcdonald, C.B., A.F.C., has been placed at the disposal of the Government of Pakistan for appointment as C-in-C. of the Royal Pakistan Air Force. He will take up the appointment in May.

A.V-M. Mcdonald has since the war been Commandant of the R.A.F. Staff College, Andover, taken the course at the Imperial Defence College, commanded the A. and A.E.E., Boscombe Down, and been Director General of Manning at Air Ministry.

He was granted a short-service commission in 1924 and, at the beginning of the war, commanded R.A.F. Station, Duxford. In 1942 he joined H.Q., 222 Group in Ceylon, and organized the fighter defences of the island. He later joined Air Headquarters, India.

Cranwell Graduation

AT the graduation parade of No. 64 Entry at the Royal Air Force College, Cranwell, on April 5th, the reviewing officer was Air Chief Marshal Sir Arthur P. M. Sanders, G.C.B., K.B.E., Commandant of the Imperial Defence College. He presented the annual awards to cadets as follows: Sen. U/Off. F. M. A. Hines, Sword of Honour, J. A. Chance Memorial Prize and Abdy Gerrard Fellowes Memorial Prize; U/Off. J. F. Merry, The Queen's Medal and Air Ministry Prize for Imperial and War Studies; Sen. U/Off. D. N. Cousins, Philip Sassoon Memorial Prize; Sen U/Off. J. N. Sawyer, Dixon Trophy and Michael Hill Memorial Prize; F/Cdt. S. M. U. Situnayake (Royal Ceylon Air Force), R. M. Groves Memorial Prize; F/Cdt. C. A. Herbert, Royal United Service Institution Award; F/Cdt. D. A. McArthur, Air Ministry Prize for Equipment Studies; U/Off. R. Horsfield, Hicks Memorial Trophy.

A photograph of the prize-winners, and of Sir Arthur Sanders inspecting the Flying Wing, appears on page 511. The order of merit of No. 64 Entry was given on page 49 of *Flight* of April 15th.

Reunion

OFFICERS of No. 60 Squadron R.A.F.: reunion dinner (lounge suits) at R.A.F. Reserves Club, 14 South Street, London, W.1, 7 p.m., Saturday, April 30th. Tickets (£1) from W/C. A. V. Moxey, Royal Air Force, Bentley Priory, Stanmore, Middlesex.

THE INDUSTRY

Aerial Re-appointment

A VISIT paid to Westland Aircraft last week by Sir Edward Boyle had a curious, if not unique, aspect. As Parliamentary Secretary to the Ministry of Supply he had been inspecting a M.o.S. establishment at Malvern, and Westlands arranged to pick him up there in a S-51 and bring him to Yeovil. On landing he was greeted with the news from Downing Street that in his absence from London he had been appointed to the post of Economic Secretary to the Treasury. The exact timing of events is uncertain, but quite possibly he changed jobs in mid-air.

After touring the works Sir Edward was flown back to Westminster, the S-51 landing at the South Bank.

On the previous day Westlands had entertained other visitors who had come from London by S-51; they were Sir Kenneth Harper, chairman of the Burmah Oil Co., Ltd., and Sir Ronald Howe, Deputy Commissioner of the Metropolitan Police.

K.H. Directors Retire

TWO directors of Kelvin and Hughes, Ltd., Mr. F. A. King and Mr. A. J. Hughes, formally retired from the Board on March 31st, after some 60 years of service with the company.

The Hughes family have been associated with navigational instruments since 1740 and Mr. A. J. Hughes was closely connected with pioneer development of the echo sounder, the aperiodic compass and the air sextant.

Mr. King spent a good deal of his business life in the Kelvin factory at Glasgow and in his early days was closely associated with Lord Kelvin and the many instruments which the great scientist designed.

Mr. King.

Mr. Hughes.

Mr. F. W. Bates, who first joined Kelvin and Hughes as an apprentice in 1927, later becoming general works manager, has now been appointed to the Board.

To Supervise Brough Servicing

APPOINTMENT of S/L. A. Firth as general service manager has been announced by Blackburn and General Aircraft, Ltd.

He will be responsible for both the aircraft and the engine post-production service, spares provisioning and supply, and supervision of the field service representatives. Mr. G. A. Kerr will continue as service manager (aircraft) with particular responsibility for liaison with the R.A.F. when the Beverley is in squadron service. S/L. Firth joined the R.A.F. as an apprentice fitter in 1923 and was commissioned in the Engineering Branch in 1941, when he formed a special unit concerned with parachute work into occupied territory. After holding a succession of increasingly responsible technical posts, he left the Service in 1947 and became chief aircraft engineer in the Department of Flight at the College of Aeronautics.

S/L. Firth.

Sir Edward Boyle (second from right) with (from left) W/C. N. J. Hulbert, M.P., a Westland director; Miss P. Laing, P.S. to Sir Edward; Mr. E. C. Wheeldon, Westland managing director; and Mr. Ivor Jehu, M.o.S. chief information officer. (See "Aerial Re-appointment".)

Elliott Brothers Entertain

THE fact that some 300 people attended the annual informal cocktail party given by Elliott Brothers (London), Ltd.—it was held on April 14th, in the historic Hutchinson House, London—is indicative of the still growing scope of this old-established firm's interests. In addition to senior officers and officials of the Services and Ministries, the guests included a number of aircraft constructors, chief designers, and test pilots.

Though it is the youngest of the company's 12 divisions, the aviation division is now one of the most important and busiest. It is currently engaged on the production of autopilots, automatic stabilizers, accelerometers, tachometers, synchronizing instruments, fuel flowmeters and other equipment.

Among the division's executives are W/C. E. G. Monk, A.F.R.Ae.S., sales manager; Mr. D. T. Broadbent, B.Sc.(Eng.), A.M.I.E.E., A.M.I.Mech.E., chief engineer; and Mr. G. Greensmith, production manager.

IN BRIEF

Reynolds Tube Co., Ltd., announce the appointment of Mr. A. H. Ashmore as general sales manager in succession to Mr. E. G. Stone, who has retired. Mr. Ashmore has been joint sales manager with Mr. Stone for several years.

* * *

Electronic instruments and components manufactured by more than twenty firms in America and on the continent of Europe will be displayed at a special exhibition being held by Rocke International, Ltd., at their headquarters at 59-61 Union Street, London, S.E.1, from April 25th to May 6th (Sunday excepted).

* * *

Suggestions made by Fort Dunlop employees gained them £2,512 in merit awards last year. Of 2,638 suggestions submitted, 40 per cent were adopted.

* * *

Awards in the Spitfire Mitchell Memorial Fund Scholarships and the 1955 Open Industrial Scholarships Examination are announced by the University of Southampton as follows: *Spitfire Scholarships.*—J. B. Ismay and J. E. Williams, both of Rolls-Royce, Ltd. *Industrial Scholarships.*—J. P. Appleton, Rolls-Royce, Ltd.; R. A. Hoare and D. H. Hughes, both of the Bristol Aeroplane Co., Ltd.

* * *

Long-service certificates were recently presented to 62 veteran employees of D. Napier and Sons, Ltd., who between them had 2,665 years' service with the company. Three employees—Messrs. F. J. Perry (supply assistant to the manager), H. C. Sutton and G. Reiderer—had each completed 50 years of service; and among 59 employees who received certificates for over 40 years' service was Mr. W. E. Lewis, M.B.E., the Acton works manager. Long-service certificates and awards were presented by Mr. H. Sammons, managing director. In three years' time, incidentally, the Napier company will be celebrating its 150th anniversary.

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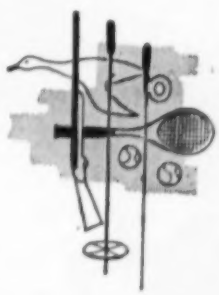

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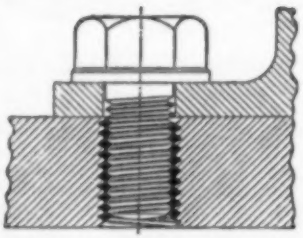

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4. Aeradio Mechanics will be employed on maintenance of radio and radar installations and Engineers Grade IV will be engaged on the planning and installation of navigational and communicational facilities at airports.

5. Conditions of Employment will in the first place be governed by the terms of the Contract and the Public Service Regulations. Successful applicants will be required to acquire within a reasonable time a knowledge of the Afrikaans language.

6. Transport Expenses from place of residence to place of employment (3rd class rail in United Kingdom, tourist, cabin or cheapest 1st class boat to South Africa, whichever is available, and 1st class rail in South Africa) including excess baggage to a maximum of 150 lbs. per adult and 75 lbs. per child and similar return passage on satisfactory completion of Contract, will be paid by the Union Government.

7. Applications in writing give full details of qualifications and previous experience should be addressed to Room 102, South Africa House, Trafalgar Square, London, W.C.2, not later than 20th May, 1955. [3606

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ENGINEERS in their Guided Weapon Development Department for hydraulic, pneumatic temperature control and instrument development work on components and systems for guided weapons. Experience in one or more of these subjects or in servomechanisms would be an advantage. Minimum qualifications for Technical Assistants are a degree, H.N.C., or equivalent; for Laboratory Assistants, O.N.C. or equivalent with workshop or development test background.

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SUITABLY qualified applicants are invited to apply personally or in writing to the Personnel Manager as soon as possible. [3599

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BLACKBURN & GENERAL AIRCRAFT, LTD., Brough, E. Yorks, require female staff to be trained for the Computing Section of their Technical Design Office. The educational qualifications required are G.C.E. advanced, i.e. Inter B.Sc. level or passed Degree level for the senior positions and G.C.E. for the junior. The work requires reasonably intelligent understanding of mathematical symbols, the use of logarithms and trigonometrical functions. This is an opportunity for girls with the right educational qualifications to enter the technical side of the aircraft industry. Applications in writing please to the Personnel Manager at the above address. Mark envelopes—"Computer." [3585

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Membership open to all Commercial and Service pilots. For full details as to the objects and particulars of Membership please write to Secretary.

ENGINEER or fitter, preferably with engine licence required for maintenance of aircraft in Birmingham area. Good opportunity for suitable applicant. Apply giving full particulars to: Don Everall Aviation, Ltd., Elmdon Airport. [3591

TECHNICAL assistants or development engineers required for test and development of air-driven turbines and associated equipment for refrigeration and pressurization of aircraft. Engineering degree or H.N.C. or equivalent an advantage. Previous experience on this type of work preferred but not essential.

WRITE in detail or send postcard for form of application, quoting Ref. 42, to: The Personnel Manager (Technical Employment), de Havilland Propellers, Ltd., Hatfield, Herts. [3572

PRODUCTION controller with experience of overhaul repairs and conversions of civil and military aircraft; first-class experience in planning, progress and stores procedure is an essential requirement. Full particulars to Personnel Manager, Field Aircraft Services, Ltd., Croydon Airport, Croydon, Surrey. [3593

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AIRCRAFT engineer, with A and C licences, required in the inspection section of the Department of Flight for interesting work on jet and piston aircraft. Wage according to age and experience. Generous holiday allowance, sick benefit and pension scheme. Application forms from Chief Clerk, The College of Aeronautics, Cranfield, Bletchley, Bucks. [3576

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PRODUCTION Manager required for an expanding organisation specialising in aircraft overhaul, repair work and manufacturing of aircraft components. Candidates should have expert knowledge of all aspects of production control, planning, progress, estimating, stores and supplies procedure, and must have first-class administrative experience. Write full particulars of experience in chronological order to Box F 316, LPE, 55, St. Martin's Lane, London, W.C.2. [3594

SENIOR estimator required for aircraft equipment engineers near Bournemouth. Interesting work, including manufacture of specialised components airframe assembly and details, and aircraft overhauls. Similar experience desirable. Good salary, pension schemes, fast transport at reduced fares, canteen and social club. Reply, stating experience and salary required to Personnel Manager, Flight Refuelling, Ltd., Tarrant Rushton Airfield, Nr. Blandford, Dorset. [3602

DRAUGHTSMEN and stressmen are required for the London design office of Saunders-Roe, Limited. Experience of aircraft structures, systems, etc., would be advantageous. You are invited to join our expanding organisation in a pleasant office, conveniently situated in West Central London. Pension and staff assurance schemes are available. Apply, quoting age, salary, experience and Ref. to the Personnel Officer, Saunders-Roe, Limited, York House, Queen Square, London, W.C.1. [3501

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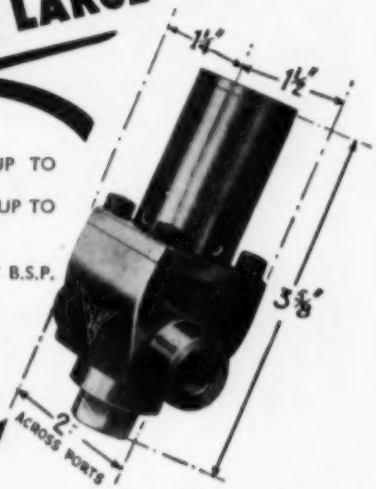

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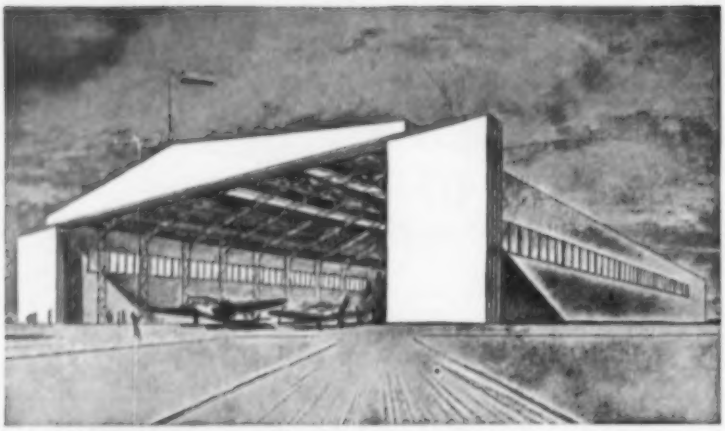

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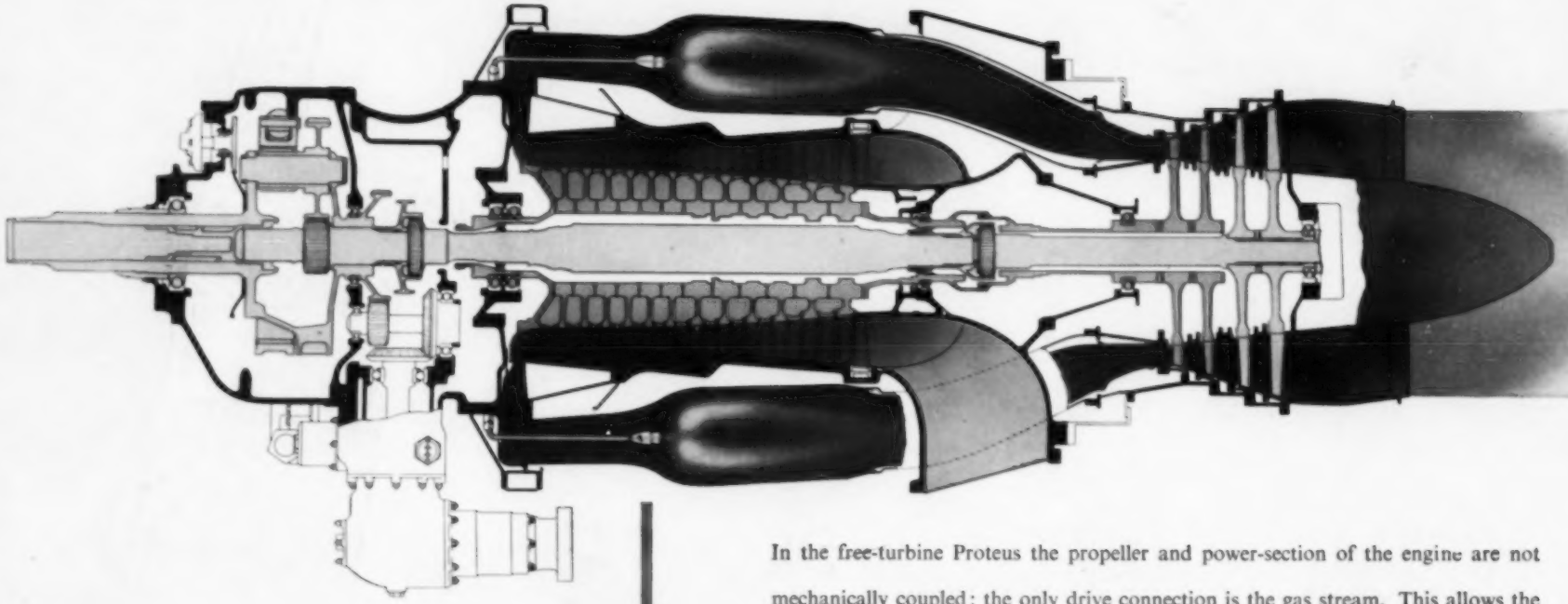

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